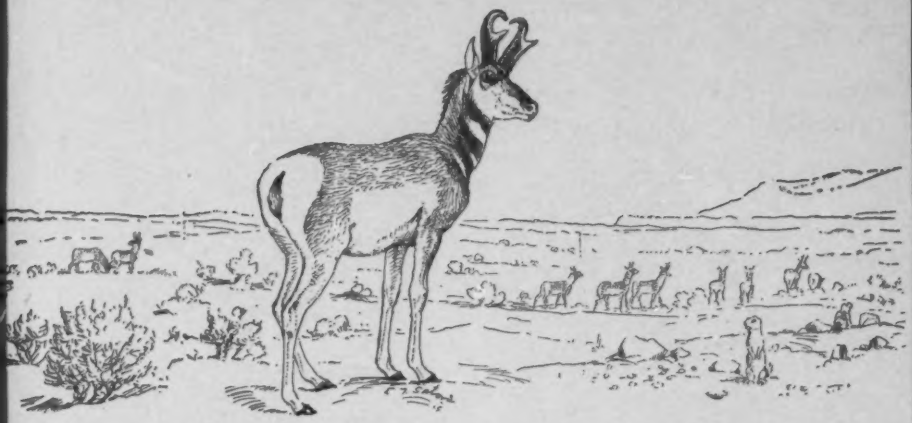
Vol. 1 NOVEMBER, 1920 No. 5

JOURNAL OF MAMMALOGY

Published Quarterly by the American Society of Mammalogists



CONTENTS

PAGE

Notes on Heude's Bears in the Sikawei Museum, and on the Bears of Palæarctic Eastern Asia ..... *Arthur de Carle Sowerby* 213

Notes on Wood Rat Work ..... *Edward R. Warren* 233

An Insular Race of Cotton Rat from the Florida Keys ..... *Glover M. Allen* 235

Description of a New Species of Beach Mouse from Florida ..... *Arthur H. Howell* 237

General Notes 240

Attacked by a Cougar? *W. H. Osgood;* The Jaguar in Colorado, *E. T. Seton;* Diurnal Nest-building by a Wood Rat, *H. H. T. Jackson;* A Second Record of Phenacomys albipes in California, with a Discussion of the Species, *A. B. Howell;* Notes on Flying Squirrels and Gray Squirrels, *D. Lange;* Dates of Shedding of Horns, *N. Hollister.*

Recent Literature 245

Editorial Comment 250

Index to Volume 1 253

PUBLISHED AT
MOUNT ROYAL AND GUILFORD AVENUES
BALTIMORE, MARYLAND

WILLIAMS & WILKINS COMPANY
BALTIMORE, U. S. A.

Entered as second-class matter, November 22, 1919, at the Postoffice, Baltimore, Md., under the Act of March 3, 1879.

The American Society of Mammalogists

Founded April 3, 1919
Incorporated April 29, 1920

C. HART MERRIAM, *President*
E. W. NELSON; WILFRED H. OSGOOD, *Vice-Presidents*
H. H. LANE, *Recording Secretary*
HARTLEY H. T. JACKSON, *Corresponding Secretary*
J. W. GIDLEY *Treasurer*
N. HOLLISTER, *Editor*

Additional Directors

1919–1921	1920–1922
GERRIT S. MILLER, JR.	T. S. PALMER
GLOVER M. ALLEN	RUDOLPH M. ANDERSON
WITMER STONE	M. W. LYON, JR.
JOSEPH GRINNELL	W. D. MATTHEW
JOHN C. MERRIAM	EDWARD A. PREBLE

Standing Committees

Publications: N. Hollister, *Chairman.* Gerrit S. Miller, Jr., Edward A. Preble, Hartley H. T. Jackson, J. W. Gidley.

Life Histories of Mammals: Chas. C. Adams, *Chairman.* Rudolph M. Anderson, Vernon Bailey, Harold C. Bryant, Lee R. Dice, Hartley H. T. Jackson, T. S. Palmer, Ernest Thompson Seton, Walter P. Taylor, Herbert Lang.

Study of Game Mammals: Charles Sheldon, *Chairman.* George Bird Grinnell.

Anatomy and Phylogeny: W. K. Gregory, *Chairman.* John C. Merriam, H. H. Donaldson, Alexander Wetmore, Hermann von W. Schulte.

Bibliography: T. S. Palmer, *Chairman.* Wilfred H. Osgood, Hartley H. T. Jackson.

Conservation: Wilfred H. Osgood, *Chairman.* E. W. Nelson, Jonathan Dwight.

The Journal of Mammalogy

Subscription rates, $3.50 per year; single numbers $1.00 each. Sent free to all members of the American Society of Mammalogists not in arrears for dues.

Manuscripts for publication, books and papers for notice and review, etc., should be sent to the Editor, N. Hollister, National Zoological Park, Washington, D. C.

Subscriptions, changes of addresses, requests for missing numbers, applications for advertising rates, etc., should be sent to the Corresponding Secretary, Dr. Hartley H. T. Jackson, Biological Survey, Washington, D. C.

JOURNAL OF MAMMALOGY

Published Quarterly by the American Society of Mammalogists

VOL. 1 NOVEMBER, 1920 No. 5

NOTES ON HEUDE'S BEARS IN THE SIKAWEI MUSEUM, AND ON THE BEARS OF PALÆARCTIC EASTERN ASIA

BY ARTHUR DE CARLE SOWERBY, F.R.G.S., F.Z.S.

Since the publication in 1897 to 1901 of Père Heude's "Memoires concernant l'Histoire Naturelle de l'Empire Chinois" there has been considerable confusion in regard to the status of many of the species of mammals that he named or described. His views on the classification of animals were such as to lead the worthy naturalist to name and describe a great many species upon such slender grounds, that he produced a state of confusion bordering on chaos in the orders and families he touched. Often he published bare names without any descriptions, or at best with fragmentary illustrations.

Thus it comes about that mammalogists have experienced considerable difficulty in satisfactorily determining the status of the Chinese species of the genera *Sus*, *Nemorhœdus*, *Urotragus*, and *Ursus*, as well as of the members of the family *Cervidæ*. Through the courtesy of the Jesuit Fathers in charge of the famous Sikawei Museum, Si-ka-wei, Shanghai, I was able in 1915 to examine much of the material upon which Heude based his names and descriptions, and so to determine with, I think, some degree of accuracy the status of the species concerned belonging to the genera and family mentioned. The results, in part, were published in a paper "On Heude's Collection of Pigs, Sika, Serows, and Gorals in the Sikawei Museum, Shanghai," in the *Proceedings of the Zoological Society of London*, April, 1917, pp. 7–26.

The present paper deals with the various species of bears found in China and neighboring eastern Asia, and is based on the examination of various skulls in the Sikawei Museum, in the Smithsonian Institution, and in my own collection.

Lest the aims of the founder and of the present proprietors of the Sikawei Museum should continue to be misunderstood, as it would seem they have been in the past, the present opportunity may be taken to state that this institution is intended to be a working museum, where good and useful scientific research may be carried out in the various branches of natural history that come within its sphere of influence. It is not merely a show place, as are so many of the museums founded and maintained by missionary societies in China. This accounts for the fact that the proprietors are reported to have refused all offers of purchase tendered by European or American museums.

Heude passed away in the midst of his labor and his work has never been completed, though Père Courtois, his successor and present curator of the museum, has attempted in the fifth volume of the *Mémoires*, published after Heude's death, to clear up the vexed question of the status of the Chinese, Japanese, and Manchurian bears. The conclusions he arrives at do not agree entirely with my own, notably in regard to Heude's *Ursus leuconyx* and Lydekker's *U. arctos yessoensis*, both of which in my opinion he places in the wrong groups or genera.

Doubtless had Heude lived to complete his work—if such work can ever be considered complete—he would have modified his views to a large extent, and reduced the number of names of species that he created.

It is to be hoped that the present attempt to clear up the subject of the names of the bears of eastern Asia, and of China in particular, will meet with the approval of the proprietors of the Sikawei Museum, without whose permission to go over and study the material it contains, nothing short of extended and costly explorations in the field could have enabled mammalogists of Europe and America to understand the species under discussion.

In the family *Ursidæ* comparatively little has been done in China, and but little is known of the bears that occur there. Although ancient Chinese writings and pictures give evidence that bears once occurred in various places, while the natives preserve semi-mythical accounts of what they call *Kou-hsüng*, *Jên-hsüng*, and *Ma-hsüng*, or dog-bears, man-bears, and horse-bears, occurring in many of the wilder parts of the country, it is probable that these animals have not been known in the greater part of Chihli, Shansi, North Shensi, Shantung, and northern and eastern Kansu for a considerable period of time, probably for centuries.

The writer has received persistent and fairly reliable reports of the occurrence of bears in the Tung Ling (Eastern Tombs) area to the

north-east of Peking in Chihli, where high, forested mountains occur. Swinhoe reported having seen bears in the hills of the Shantung Promontory. Bears undoubtedly occur in western Honan, north-western Hupeh, southern Shensi, and southern and western Kansu. They also occur in Ssŭ-chuan (Szechuan), and the maritime provinces of Chekiang and Fokien; while they are positively numerous in the forests of Manchuria and north-eastern Corea. In the islands off the east Asiatic coast they are known from Great Shantar Island, in the Okhotsk Sea, near the mouth of the Amur, from Saghalin, Yezo, Japan, Formosa, and Hainan Island.

It is only to be expected that in so large and varied an area a number of different species occur. But few specimens, however, have reached European or American museums, so that Heude's collection of skulls is of peculiar interest and importance, and their proper examination throws much light upon this hitherto imperfectly understood subject.

Representing the *Ursidæ* there are in the Sikawei Museum some twelve skulls from various localities as follows:—

1. A skull labelled *Selenarctos leuconyx* from the "montagnes de Pao-ki (Chensi boreal), 1886, Mars, Mgr. Vidi."

N.B. Pao-ki, or Pao-chi, is not in North Shensi, as Heude seems to have supposed, but lies to the west of Si-an Fu, south of the Wei River, at the foot of the great mountain system known as the Tai-pei Shan, in the Ching Ling range, where the late Mr. Malcolm P. Anderson discovered the famous Chinese takin (*Budorcas bedfordi* Thos.).

2. Two skulls from Hakodate (Yeso, Yezo, or Jeso), north Japan.
3. A skull from Moupin (N. W. Ssŭ-Chuan and Tibet.)
4. An immature skull from the Ussuri region.
5. An immature skull labelled Kamschatka.
6. A skull labelled "bought from a pedlar of bric-a-brac in Chang-hai (Shanghai), Malaisie?" with *Selenarctos* written on the skull itself.
7. A skull from Vladivostok.
8. A skull from the "District de Behring."
9. Three skulls of the Malayan bear, labelled "*Helarctos*."

I could not find the skulls of Heude's *U. melanarctos* or *Melanarctos cavifrons*, and so was forced to make use of the figures in his plates for these.

In making my examination of these specimens I had with me three skulls and photographs of a fourth for comparison. One of these skulls was that of a female black bear from the Himalayas, shot by Captain H. L. Haughton of the 36th Sikhs, who gave it to me when

he was in Tientsin with his regiment. The other two skulls were of a fully adult male and a fully adult female of the Manchurian black bear, secured by me in the forests of North Kirin, I-mien-p'o district (near Ninguta); while the photograph was of the skull of a large grizzly-like bear shot by me in the same district.

After a careful examination of the skulls I had at my disposal, and a comparison of these with the figures in Heude's *Memoires* and Courtois' note, and with due reference to other literature on the subject, I come to the conclusion that the bears of the regions under discussion are divisible into several generic groups, but three of which directly concern us here. These are:

1. *Selenarctos* HEUDE (= *Arcticonus* Pocock).
   Type. *Ursus thibetanus* Cuv.
2. *Ursus* LINNÆUS (= *Ursarctos* Heude).
   Type. *Ursus arctos* Linnæus.
3. *Spelæus* BROOKES (= *Danis* Gray, and Pocock; *Spelæarctos* E. Geoffroy; and *Melanarctos* Heude).
   Type. *Ursus spelæus* Rosenmüller.

In thus dividing the bears of these regions that were formerly all placed in the one genus *Ursus* into three genera, I am conforming to the tendencies of modern systematists, and am bringing these groups into line with *Thalarctos*, the polar bear; *Euarctos*, the North American black bear; *Tremarctos*, the South American spectacled bear; *Melursus*, the Indian sloth-bear; and *Helarctos*, the Malayan sun bear.

As a matter of fact Mr. R. I. Pocock,[1] has preceded me in this form of classification, but his *Arcticonus* is, unfortunately, synonymous with Heude's much earlier *Selenarctos* for the bears of the *Ursus thibetanus* group; while his revival of Gray's *Danis* for the group to which the grizzlies belong cannot stand, since that name was first used by Fabricius for a genus of insects in 1808, and so was preoccupied, Gray having applied it to the grizzlies in 1825.

I. Selenarctos Heude, 1901

Mémoires concernant l'Histoire Naturelle de l'Empire Chinois, vol. V, p. 2, 1901.
Type:—*Ursus thibetanus* Cuvier.

The bears in this genus belong to the Himalayan black bear, *Ursus thibetanus* Cuv., group, and are characterized by having a pure black

[1] See R. I. Pocock's valuable papers on this subject in the P. Z. S., 1914, pp. 889–941; Ann. Mag. Nat. Hist., ser. 8, vol. XX, pp. 128–130, 1917; and ibid., ser. 9, vol. I, pp. 375–384, 1918.

pelage, with a conspicuous white crescentic collar on the chest, often also with a white chin; long, rounded ears; longish hair; and the plantar and carpal pads joined together, but separate from the digital pads.

It contains the species: *Selenarctos thibetanus* (Cuv.) (= *U. torquatus* Blanford), *S. mupinensis* Heude, *S. macneilli* (Lydekker), *S. ussuricus* Heude, *S. japonicus* (Schlegel), and *S. formosanus* (Swinhoe), as well as the black bears from Chekiang, Fukien, and Hainan Island.

The skulls I examined belonging to this group were No. 2, the two skulls from Hakodate, No. 4, the Ussuri skull, No. 5, the skull labelled Kamschatka, No. 6, the skull bought from the Shanghai pedlar, my own two skulls from Manchuria, one of which, the male, I subsequently sent to the Smithsonian Institution, and the one given me by Captain Haughton from the Himalayas, altogether nine skulls from seven localities. Both Heude and Courtois wrongly classed the species *leuconyx* Heude, from Shensi with this genus. It rightly belongs to *Ursus*, and so the skull representing it cannot be considered here.

In creating the genus *Selenarctos* Heude paid no attention to the South American genus *Tremarctos*, in which Pocock for sometime included the bears of the *thibetanus* group, after having separated them from *Ursus* on their external characters. The latter authority, however, in his recent paper in the *Annals and Magazine of Natural History*, series 8, vol. 20, p. 129, 1917, has at last separated, under the name *Arcticonus*, the *thibetanus* group from *Tremarctos*, basing this separation on cranial characters—*Tremarctos* having a much shorter skull than the bears of the *thibetanus* group—, and remarking that there are probably differences in the feet and nose which will be revealed when fresh specimens can be examined.

There is no doubt that Heude meant the bears of the *thibetanus* group when he created the new generic name *Selenarctos*, for he specifically mentioned Cuvier's *Ursus thibetanus*, and enumerated others, *mupinensis*, *ussuricus*, and *japonicus*, as species which were commonly confused with it, being of a black pelage with the white crescent on the chest. The name *Selenarctos* therefore takes precedence over *Arcticonus*, and as first reviser of the group I select Cuvier's *Ursus thibetanus* as the type of *Selenarctos*, Heude having failed to choose one.

Taking the skulls of the bears of this group that I examined, I found that the one bought in Shanghai (No. 6.) bore a close resemblance to that of the male bear from Kirin, but was narrower throughout, especially across the forehead; while the posterior molar in the upper jaw was very much smaller than that of the latter (25 mm. x 14.5 mm.

as compared with 30 mm. x 16 mm.). In this respect it came nearest to the Himalayan skull, in which the same tooth was 24 mm. x 14.5 mm. On the other hand the Himalayan skull was broader, proportionately, than the Kirin one, so that this skull could hardly belong to *thibetanus* (erroneously known as *torquatus* Blanford). Taking all the facts into consideration this skull probably came from Chekiang or Fokien, and represents an undescribed species, but since this cannot be proved it is unprofitable to discuss the specimen further.

1. Selenarctos thibetanus (Cuvier)

Ursus thibetanus Cuvier, Mam., 1824, pl. 213.
Ursus torquatus Blanford, S. S. S., II, 1841, p. 144, pl. 141 D.
Type locality:—"Sylket and Nepal."

That Wagner was wrong in substituting Blanford's name *torquatus*[2] for Cuvier's *thibetanus* on the grounds that it was a misnomer because "Sylket and Nepal" are not in Tibet is evident. Such a procedure does not conform with those laid down in the International Code. Since, then, the same species extends from Nepal right through the Himalayas, its name must be *thibetanus*, and Blanford's *torquatus* becomes a synonym.

The chief point of difference between this and the next species, *mupinensis* Heude, lies in the size of the posterior molar in the upper jaw. This tooth in the Himalayan specimen measured 24 mm. x 14.5 mm., and in the Moupin skull (a male) 28 mm. x 15.5. Of course the difference in the sex has something to do with this, but, judging from what occurs in the other species, it does not fully account for the difference in the teeth. It will be noticed that the upper posterior molar of *thibetanus* is very much narrower than in *ussuricus*.

Following are measurements of the skull of the female black bear from the Himalayas:—

	Inches
Greatest length	11.0
Greatest width	7.5
Inter-orbital space	2.94
Greatest width of cranium	4.25
Greatest depth of cranium	3.87
Width of palate	1.75
Depth of muzzle	2.38
Width of muzzle	2.5
Length of lower jaw	7.75
Depth of lower jaw at posterior molar	1.75
Depth of lower jaw at angle	4.5

[2] *Schreber's Saügth., Suppl. Vol. II, p. 144. 1841.*

	mm.
Length of upper posterior molar	24.0
Width of same	14.5

These measurements show that the Himalayan black bear has a wider and deeper skull than the Manchurian form, and wider than the Moupin form, though the muzzle and palate are narrower. The lower jaw is very much heavier, but has smaller teeth. . Another noticeable feature is that the cranial outline of the Himalayan form is more convex, dorsally, than that of the Manchurian form. In external characters the two species *thibetanus* and *ussuricus* are much alike, except that the latter seems to have longer hair on the sides of the head and neck.

The very small size of the upper posterior molar is interesting, as the following table of measurements of this tooth in the various species shows that it increases in size in the species from west to east.

1. Himalayan skull ♀ 24 mm. x 14.5 mm.
2. Moupin skull ♂ 28 mm. x 15.5 mm.
3. Kirin skull ♀ 27 mm. x 15 mm.
4. Kirin skull ♂ 30 mm. x 16 mm.
5. Kamschatka skull (Imm.) 31 mm. x 16 mm.

The Shanghai bought skull, a male, has this tooth measuring 25 mm. x 15 mm., which, allowing for a corresponding difference between male and female in the species to which it belongs, such as exists in *ussuricus*, we must conclude represents a species with an even smaller posterior molar than *thibetanus*.

Habitat:—The range of this bear apparently extends from Nepal, throughout the Himalayas into Southern Tibet.

2. **Selenarctos mupinensis** Heude

Selenarctos mupinensis, Heude, Mém. conc. l'Hist. Nat. de l'Emp. Chin., vol. V, p. 2, pl. II, figs. 1, 2, 9, 1901.
Type:—An adult male in the Sikawei Museum, Shanghai.
Type locality:—Moupin (N. W. Ssŭ-chuan and E. Tibet).

There can be little doubt that the black bear from Moupin is distinct from the Himalayan form on the one hand and the Manchurian form on the other. Its skull is narrower than in *thibetanus*, the same or slightly broader than in *ussuricus*; while the upper posterior molar is larger than in *thibetanus* and smaller than in *ussuricus*.

Habitat:—The range of this species appears to be N. W. Ssŭ-chuan, S. W. Kausu, and E. Tibet.

3. **Selenarctos macneilli** (Lydekker)

Ursus torquatus macneilli LYDEKKER, Proc. Zool. Soc. Lond., 1909, pp. 607–610.
Type locality:—Ta-chien-lu, W. Ssŭ-chuan.

There was no specimen of the black bear from western Ssŭ-chuan in the Sikawei Museum with which to compare those from other parts, but from Lydekker's description of it it would appear to be very distinct. The latter states that this species has smaller cheek teeth than the Himalayan species, and also a broader skull. It thus cannot be placed with *mupinensis*, in spite of the fact that its type locality is so close to that of the latter. It seems to me to represent the black bears that inhabit South Shensi, West Honan, and North-west Hup'eh, as well as Ssŭ-chuan. In the figure accompanying Lydekker's decription the names of the two species from the Himalaya and West Ssŭ-chuan seem to have been interchanged, or else his description is wrong, and the narrower skull figured really represents his *macneilli*. The latter was further described as having longer and softer hair than *thibetanus*.

Habitat:—The range of this bear is probably from West Ssŭ-chuan, eastward to West Honan and North-west Hup'eh, and north into South Shensi.

4. **Selenarctos ussuricus** Heude

Selenarctos ussuricus HEUDE, Mém. conc. l'Hist. Nat. de l'Emp. Chin., vol. V, p. 2, pl. II, fig. 10, 1901.
Type:—An immature skull in the Sikawei Museum, Shanghai.
Type locality:—The Ussuri, Eastern Manchuria.

In the immature skull, supposed to be from Kamschatka, the upper posterior molar was 31 mm. in length, while in the Ussuri specimen, a much younger one, and probably a female, the same tooth was only 25 mm. in length. In my specimens from Kirin this tooth was 27 mm. in the female, and 30 mm. in the male. As none of the skulls from other districts showed this tooth to be larger than 28 mm. (i.e., in the male from Moupin), it appears that the large size of this tooth is characteristic of the Manchurian species. Another distinguishing feature is the proportionate narrowness of the skull.

From a comparison of the skulls from Kirin, the Ussuri, and Kamschatka, I do not hesitate to class them together as representing one species, and since Heude has given the name *ussuricus*, accompanied with a figure (upper molar tooth row), though without a description, this name must stand.

This is unfortunate, for the type specimen is a poor one, though, taking into consideration its age, it shows the main distinguishing characters in the skull of the species.

In order to show this more clearly, and to remove any possibility of doubt as regards the distinctness of the Manchurian black bear from any of the more westerly forms, I give the following description and measurements of a fully adult female from the I-mien-p'o district of North Kirin, whose skin and skull now lie in the Smithsonian Institution at Washington.

Adult ♀. U. S. Nat. Mus. No. 199684. Collector's number, 723. Locality, 20 miles north of I-mien-po, N. Kirin, Manchuria. Alt. 700 ft. Shot October 10th, 1914. Presented to the United States National Museum by Mr. R. S. Clark.

Measurements in the flesh:—Length of head and body, 60 inches; tail, 2.4 inches; hind foot (s. u.), 7.9 inches; ear, 6 inches.

Color:—Pure black, with well defined white, crescentic collar on the chest, extending to the forepart of the shoulder; chin white.

The hair is long and soft, increasing in length on the sides of the neck and head to about 8 inches, giving the appearance of a fine mane.

Skull

	Inches
Greatest length	11.83
Greatest width	7.25
Inter-orbital space	2.88
Greatest width of cranium	4.0
Greatest depth of cranium	3.5
Width of palate	1.82
Depth of muzzle	2.25
Width of muzzle	2.62
Length of lower jaw	7.62
Depth of lower jaw at posterior molar	1.51
Depth of lower jaw at angle	4.25
	mm.
Length of upper posterior molar	27.0
Width of upper posterior molar	15.0

The dorsal outline of the skull is fairly straight, slightly convex about the cranium. There is a fairly well pronounced parietal ridge (more pronounced in male), and the skull compared with those of other members of the group is narrower than in the Himalayan form, about the same as in the Moupin form, and broader than in the Japanese form.

The teeth, also, especially the canines, and the upper posterior molar, are larger than in the other forms.

Habitat:—The range of this species probably extends from western Manchuria (W. Heilungkiang Province) throughout the forested areas of that country, eastward to the Primorsk, north-eastward into Kams-

chatka,[3] and southward into North Corea. Its northern limit does not appear to have been determined, but it extends at least into the Amur country, though Schrenck did not record it in his great work on that region.

5. **Selenarctos japonicus** (Schlegel)

Ursus japonicus, SCHLEGEL, Handl. Beaef. Dierk. I, p. 42, 1857.
Selenarctos japonicus (Schlegel) HEUDE, Mém. conc. l'Hist. Nat. de l'Emp. Chin., vol. II, p. 2, pl. II, figs. 5, 6, & 7, 1901.
Type locality:—Japanese Islands.

Heude figures in his *Mémoires*, the skull of a bear from Japan, which he refers to Schlegel's *japonicus*. This undoubtedly represents the Japanese black bear, at once distinguishable from the mainland forms of *Selenarctos* by the extreme (for the genus) narrowness of the skull. In this it approaches the *Ursus* group, and is so like the skull labelled *leuconyx* from Pao-chi, Shensi, that Heude and Courtois both classed the latter with *Selenarctos*. A more careful examination of the respective skulls revealed the fact that the *leuconyx* one was longer in the muzzle, and really belonged to *Ursus*.

It is interesting to note that the broadest skulls in this group, with the exception of that of *Selenarctos formosanus* (Swinh.) our next species, which is broader than any other, occur in the extreme west of the known range of the genus, and the narrowest in the extreme east, the intermediate forms, *mupinensis*, and *ussuricus* being intermediate in this respect.

As regards the color and external characters Sclater (*P. Z. S., 1862, p. 261*) wrote concerning some bears of this species in the London Zoological Gardens at the time:

> Our specimens, the largest of which must be nearly full grown. . . . . are barely two thirds the size of *Ursus torquatus*. The very distinct white gular band of *Ursus torquatus* is only represented in *Ursus japonicus* by a slight undefined whitish line, which seems likely to wholly disappear. The muzzle is also much blacker in *U. japonicus* than in *U. torquatus;* and instead of the prominent bushy cheeks of *U. torquatus*, the Japanese species appears to have the face clothed only with short hairs, as in *Ursus americanus*.

He also remarks that *S. japonicus* appears to be intermediate between the Himalayan black bear and the American black bear, a fact also born out by the skull of *S. japonicus*.

Habitat:—The Japanese Islands.

[3] Corroborative evidence of the existence of this type of bear in Kamschatka is lacking.

6. **Selenarctos formosanus** (Swinhoe)

Ursus formosanus SWINHOE, Proc. Zool. Soc. Lond., 1864, p. 380.
Ursus torquatus formosanus (Sw.) LYDEKKER, Proc. Zool. Soc. Lond., 1909, pp. 607–610, fig. p. 608, c.
Type locality:—Formosa.

This species was first named by Swinhoe, who however gave very meagre details. In 1909 Lydekker gave a figure of a skull of the Formosan black bear, and confirmed Swinhoe's diagnosis of it as distinct from any of the other known forms. Its chief characteristics are its shorter and broader skull, and its broad and short last molar. It thus approaches to the skull in Sikawei Museum that was bought from a pedlar in Shanghai, and to the Himalayan form. Its skull is, however, proportionately shorter and wider than any other known species. Lydekker gives the following measurements: Basal length, 9.1 inches; maximum zygomatic width, 6.95; length of last 3 upper cheek teeth, 2.25.

From the shape and proportions of the skull figured by Lydekker there is no doubt about this form belonging to the genus *Selenarctos*. Swinhoe gave its hair as stiff, and black, and remarked on the presence of a white crescent.

We thus have six recognizable species of *Selenarctos*, and apparently three more unidentified forms, namely: (1) the black bear from Chekiang and Fukien in south-eastern China, a stuffed specimen of which exists in the museum of the North China Branch of the Royal Asiatic Society, Shanghai, the skull unfortunately being inside the specimen, (2) the black bear from Hainan Island, which has been confused with *S. thibetanus* (or *torquatus*), and (3) the black bear that inhabits (but is rapidly becoming extinct) the forested and mountainous country to the north-east of Peking in Chihli, known as the Tung Ling and Imperial Hunting Grounds.

II. **Ursus** Linnæus, 1758

Syst. Nat., Ed. X, I, p. 47, 1758.
Type:—*Ursus arctos* Linnæus. (Scandinavia.)

The bears that belong to what Heude called the *Ursarctos* group, must be placed in the genus *Ursus*, of which *Ursus arctos* of Scandinavia is the type.

These have longer skulls than the members of the *Selenarctos* group, do not have a pronouncedly high forehead, as in *Spelæus* group, and,

as far as is at present known are brown, light buffy-brown, grayish, or whitish in their pelages. There is usually no sign of a white crescentic collar, except sometimes in the very young cubs. The soles of the feet have the plantar and carpal pads cleft across in the hind feet, sometimes with, sometimes without hair in the cleft; while the digital pads are separate. In the forefeet the plantar and carpal pads are separated, the former being reduced to a small round knob. The feet are thus very distinct from those of *Selenarctos*.

The group was represented amongst the skulls I had for comparison by No. 1, labelled *leuconyx* from Pao-chi, Shensi, No. 6, the one from Vladivostok (*mandchuricus*), and No. 7, the one from the Bering region called *beringianus*.

As regards the name *Ursarctos*, it was applied by Heude to the Vladivastok brown bear, *mandchuricus*, and to the Bering skull, the locality of the latter being very vague. Since neither of these can be separated generically, or even subgenerically from true *Ursus*, the name *Ursarctos* cannot be used.

It is in the genus *Ursus* that the greatest confusion seems to reign, due largely to lack of sufficient material from properly identified localities, and to the close connection between this genus and our next, *Spelæus*.

As regards the bears of eastern Asia the following species may for the present be included in the genus *Ursus*:—(1) *Ursus collaris* Cuvier, of Siberia, (2) *U. isabellinus* Horsfield, of the Himalayas, (3) *U. pruinosus*, Blyth, of the Himalayas, (4) *U. lagomyiarius* Sewerzow, of central Asia and north-western China, (5) *U. beringianus* Middendorff, of Great Shantar Island, (6) *U. mandchuricus* Heude, of Manchuria and the Amur, and (7) *U. yesoensis* Lydekker, of Yezo or Hakodate.

Of these it is possible that *U. pruinosus* and *U. lagomyiarius* may be found to be subgenerically, or even generically distinct from *Ursus*, and possibly more closely allied to *Spelæus*; but until more material from all parts can be gathered for comparative purposes this cannot be determined.

7. **Ursus collaris** Cuvier

Ursus collaris Cuvier, Hist. Nat. Mamm., livr. XLIII, 1824.

This apparently is the brown bear of the true *Ursus* group that inhabits Siberia. Trouessart gives its range as the Ural Mountains, Siberia, Batang, and Tengri-Nor. It is generally supposed to range into Kamschatka, but this is open to doubt. It is rather a light brown, with dark brown rings round the eyes.

8. **Ursus isabellinus** Horsfield

Ursus isabellinus Horsfield, Trans. Linn. Soc., vol. XV, p. 322, 1826.
Ursus arctus isabellinus Hors., Lydekker, P. Z. S. 1897.

This is the so-called Himalayan snow-bear, or red-bear. It is a very pale form, buffy like *U. syriacus*, from which it differs in having the ears very hairy. It is possible that this species belongs more truly to the cave bears than to the brown bears, and so should be placed in the genus *Spelæus*.

9. **Ursus pruinosus** Blyth

Ursus pruinosus Blyth, Journ. Asiatic Soc. Bengal, vol. XXII, p. 589, 1858; Lydekker, P. Z. S., 1897, p. 426, pl. XXVII (colored).
Type locality:—Tibetan Himalayas.

The Himalayan blue-bear, as this species is called, is a small species, with long hair of a white and grey above, merging into blackish on the legs and feet. A good account of it has been given, together with a colored figure, by Lydekker in his paper "The Blue Bear of Tibet, with Notes on the Members of the *Ursus arctus* Group.," P. Z. S., pp. 412–426, pl. XXVIII, 1897.

As already suggested this species, together with our next, may prove to be generically, or sub-generically distinct from *Ursus*.

10. **Ursus lagomyiarius** Sewerzow

Ursus lagomyiarius Sewerzow, Fauna Turkestan, 1874.
Ursus lagomyarius, Sew. Przewalski, Reis. Mongol. I, 1876.—Cat. Zool. Coll. of H. M. Przewalski, p. 9, no. 1, 1887, St. Petersburg.

This appears to be a close relation of *Ursus pruinosus*, that occurs in the highlands of central Asia, northern Tibet and possibly northwestern China. It is larger than *pruinosus*, however, and apparently less white in color.

Another bear belonging to this group, or at least related to it, is that named *Selenarctos leuconyx* by Heude, a skull and paws of which were sent to him from Pao-chi in West Shensi. The name *leuconyx* had already been used by Severtzow (= Sewerzow) in naming a bear from the Altai (*Ursus leuconyx* Severtzow, *Nachr. Ges. Moscou, VIII, 1873, p. 79, pl. II.*), but there is nothing to show that Heude meant to refer the Pao-chi specimen to this species. On the contrary he classed it with the *Selenarctos*, or black bear group, which he had separated from *Ursus*.

Since then the Pao-chi form is distinct from Severtzow's *U. leuconyx*, which nevertheless does not seem to belong to the genus *Ursus*, but to *Spelæus*, and since when Heude used the name *leuconyx* it was already preoccupied by a bear at that time placed in the genus *Ursus*, it cannot now be used for the Pao-chi species, although the latter turns out to belong to *Ursus*, while Severtzow's species seems to belong to *Spelæus*.

The Shensi brown-bear (sic) represented solely by the skull from Pao-chi in the Sikawei Museum therefore requires a new name, and since it has been entirely due to the generosity of my friend, Mr. Robert Sterling Clark, that I have been able to carry out my exploration work in China, Mongolia, and Manchuria, I have decided to name this species in his honor. It may thus be known as:

11. **Ursus clarki** nom. nov.

Selenarctos leuconyx HEUDE, Mém. conc. l'Hist. Nat. de l'Emp. Chin., vol. V, p. 2, p.. II, figs. 3, 4, 8, 1898. (*nom. preoc.*)

Type:—A skull in the Sikawei Museum, Shanghai.

Type locality:—Mountains of Pao-chi (*i.e.* the Tai-pei Shan of the Ching Ling Range.), S. W. Shensi.

In this species the skull is narrow, with rather long muzzle and jaws, and a somewhat convex cranial outline. Heude says that the paws of his specimen, which is the type, are white; and this is all that is known of the color of the species. When I was in this locality I made enquiries concerning the form of the bear inhabiting these mountains, and was told that it was whitish in color with some black about it. Later, when hunting in the mountains of the Tai-pei Shan, I came across evidences of the existence of bears there, but did not see a specimen. The species would seem to represent *U. pruinosus* in this region.

Habitat:—Probably the whole, or greater part of the Ching Ling Range, up to 11,000 ft. or 12,000 ft. altitude.

12. **Ursus mandchuricus** (Heude)

Ursarctos mandchuricus HEUDE, Mém. conc. l'Hist. Nat. de l'Emp. Chin., vol. IV, pp. 23–24, pl. VII, figs. 1–1e, 1898.

Type:—A skull in the Sikawei Museum, Shanghai.

Type locality:—The Ussuri region, near Vladivostock, Manchuria.

This is a large mainland brown bear that inhabits the forests of eastern, central (?), and northern Manchuria. I have seen a number

of skins of brown bears from Manchuria, and can say that they are brown, usually a good deal darker than that of *Ursus collaris* Cuv., and are without the brown patch encircling the eye. The color is not so dark as in *U. beringianus* Midd. from Great Shantar Island (not the Bering region), and still less dark than that of *Spelæus piscator* (Puch.) from Kamschatka, with which it and *U. beringianus* might be, and apparently have been confused.

The skull of *U. mandchuricus*, as exemplified by the Sikawei specimen, is very heavy and rugged, with a fairly straight cranial outline, rising but slightly at the forehead. The muzzle is shorter and broader than in the skulls of the next genus, *Spelæus*, though less deep.

Judging from the size of the skull in the Sikawei Museum the species must be a very large one, a fact also born out by the large size of good Manchurian skins.

Habitat:—The range of this species probably extends from the Ussuri northward and westward, embracing the Amur Valley, and possibly extending into Eastern Siberia and Kamschatka.

13. **Ursus yesoensis** Lydekker

Ursus arctus yesoensis LYDEKKER, Proc. Zool. Soc. Lond., 1897, pp. 422–423, fig.
Type in the British Museum collections.
Type locality:—Hakodate, Yezo.

In 1897 Lydekker described a bear from Hakodate under the name *Ursus arctus yesoensis*, giving a figure of a skull. In 1901 Père Courtois in volume V of the *Mémoires* confused this bear with Heude's *melanarctos*, which belongs to our next group. As Lydekker states distinctly that his *yesoensis* is a brown bear, while Heude states equally emphatically that *melanarctos* is pure and deep black, it is obvious that the two forms are distinct. The skull figured by Lydekker does not agree with the characters of *melanarctos*, and is, in effect that of a true brown bear. It has a very convex cranial outline.

Habitat:—The island of Yezo, N. Japan; possibly also Saghalin Island.

14. **Ursus beringianus** Middendorff

Ursus arctos var. *beringiana* MIDDENDORFF, Reis. im. den äuss. Nord. u. Ost. Sibir., vol. I, pt. II, pl. 1, 1851.
Type locality:—Great Shantar Island.

The skull of the bear from the Bering region in the Sikawei Museum agrees, as far as I could make out, with those of true *Ursus;* but there

was no means of ascertaining whether it represented *U. beringianus* or not. Both Heude and Courtois seem to have considered it to belong to Middendorff's species. Its label marked "District de Behring" suggests that it came from very much further north than Great Shantar Island, which is near the mouth of the Amur, in the South Okhotsk Sea, and is the type locality of *beringianus*. In this case the skull probably belongs to some other form.

U. beringianus is a large, dark brown species, to judge from specimens in the Tring Museum. But at best it can only be considered an island form of the mainland *U. mandchuricus*.

Habitat:—Great Shantar Island.

III. **Spelæus** Brookes, 1828[4]

Cat. Anat. & Zool. Museum of Josh. Brookes, London, 1828.

Type:—*Ursus spelæus* Rosenmüller, (= *Spelæus antiquorum* used by Brookes).

Belonging to this group of bears, to which Heude gave the generic name *Melanarctos*, and which contains the prehistoric cave-bears as well as the recent cave-bears or grizzlies, there are some three species known to occur in eastern Asia, and apparently a fourth in central Asia. These are: (1) *Spelæus melanarctos* (Heude) from Yezo, (2) *S. cavifrons* (Heude) from Manchuria, (3) *S. piscator* (Pucheran) from Kamschatka, and (4) *S. leuconyx* (Severtzow) from the Altai region.

These may be considered the Asiatic representatives of the American grizzlies on the one hand and the extinct European cave-bears on the other.

They are large species, in which the skull is very long and narrow, relatively more so than in *Ursus*, with very high foreheads so that the cranial outline at this point is strongly concave. The cranium itself is very narrow, the muzzle and jaws narrow and deep. The soles of the feet agree very much with those of *Ursus*.

From the general appearance of the skulls of Heude's two species, *S. melanarctos*, and *S. cavifrons*, it is evident that this authority was right in separating these bears from the *Ursus* group. In this connection Mr. Gerrit S. Miller, Jr., referring to a specimen of *cavifrons* secured by me in the Manchurian forests, has written me under date of January 17, 1917, as follows:—

[4] This name precedes E. Geoffroy's *Spelæarctos*, Rev. Encyclopedique, 59, p. 81, 1833.

Yesterday, in company with Dr. C. Hart Merriam and Mr. James W. Gidley, I compared your skull of Manchurian "*Melanarctos*" (U. S. Nat. Mus. No. 199683) with skulls and teeth of cave bears from the Pyrenees, with the Kamchatkan *Ursus piscator* and the largest grizzlies and brown bears of western North America. We found it impossible to separate these animals by cranial and dental characters into subgeneric groups. Such differences as occur, for instance those distinguishing the extinct Pyrenean bears from living Alaskan species, and those distinguishing your animal from either of these two or from *Ursus piscator*, are no greater than the differences present among various forms now occurring in North America. In other words the characters are merely specific. In its past and present distribution this group of bears resembles some of the lagomorphs and rodents. The genus *Ochotona* ranged west to England in the Pleistocene; it is now confined to Asia and western North America. A Pleistocene *Microtus* of the "*Stenocranius*" group has been found in southern England. The group now ranges from the Altai Mountains to Alaska. Probably there are several other instances of the same kind.

My specimen, referred to by Mr. Miller, is a fine sample of its kind. It was shot by myself in the forest to the north of I-mien-p'o, in Kirin Province, and was sent to the Smithsonian Institution. It and Heude's two specimens of *cavifrons* and *melanarctos* are the only ones of these particular species known to exist in any recognized museum, and are therefore of great importance.

On the question of whether or not this genus is distinct from *Ursus* there seems to me to be little doubt; though it is not quite clear, owing to lack of material for examination, exactly which species belong to which genus.

Pocock has separated the grizzly bears from *Ursus* on the strength of the fact that the skin between the toes extends much further towards the tips in the former than in the latter. He used the name *Danis* Gray (1825), which, as already pointed out, is preoccupied (Fabricius, 1808). Thus Brookes' catalogue name *Spelæus* (1828), based on *Spelæus antiquorum* (= *spelæus*), as the next oldest is the correct one for this group of bears. If, however, as Mr. Miller has pointed out *in litteris*, it should be found that the living 'cave' bears can be separated from their extinct ancestors, then Heude's name *Melanarctos* would be the correct one for the recent group. There seems no way but to accept Brookes' name, in spite of its appearing in a sale catalogue of his collection.

15. Spelæus melanarctos (Heude)

Ursus melanarctos HEUDE, Mém. conc. l'Hist. Nat. de l'Emp. Chin., vol. IV, pp. 17–18, pl. VIII, figs. 1–1c, & pl. VII, figs. 2–2a, 1898.
Type:—A skull in Sikawei Museum, Shanghai.
Type locality:—Yezo, N. Japan.

This was the first of the two species to be discovered. It occurs in the island of Yezo, where Heude emphatically declares three species of bear occur, namely *melanarctos*, *yesoensis*, and *japonicus*. He distinguishes *melanarctos* as being of an intense black, with no light markings at all. The skull is large and heavy, with a longer and proportionately narrower muzzle than in the true *Ursus* group. The forehead is high, giving the profile of the skull a concave outline. Heude's description is very meagre, and so far as I am aware no other publication on this animal occurs, excepting that in volume V, of the "Mémoires," in which Courtois confuses this bear with Lydekker's *Ursus yesoensis*.

Habitat:—Yezo Island, N. Japan.

16. Spelæus cavifrons (Heude)

Melanarctos cavifrons HEUDE, Mém. conc. l'Hist. Nat. de l'Emp. Chin., vol. V, pt. 1, p. 1, pl. I, figs. 6–8, 1901.
Type:—A skull in the Sikawei Museum, Shanghai.
Type locality:—Tçi-tçi Har (Tsi-tsi-har), N. W. Manchuria.

This bear is very distinct from any of the other mainland forms. It is distinguishable from *Ursus mandchuricus*, which it resembles in size, by its high forehead, narrower and deeper muzzle, black pelage, and coarse hair.

While in the I-mien-p'o district of North Kirin, I secured a specimen of a bear which can only be referred to this species. The skull agrees very closely with Heude's figure. As Heude's description is not as full as it might be, I give the following account of my specimen.

Fully adult ♂. U. S. Nat. Mus. No. 199683. Collector's number, 722. Locality, 20 miles north of I-mien-p'o, N. Kirin, Manchuria. Alt. 700 ft. Shot October 8th, 1914. Presented to the United States National Museum by Mr. R. S. Clark.

Measurements in the flesh. Length of head and body, 79 inches; tail, 5.5 inches; hind foot (s. u.), 10.2 inches; ear, 6 inches.

Color: Generally black, merging into brown on the muzzle; brownish on the head; a band of slightly lighter color over the shoulders, owing to hairs being

of a light chestnut color at their bases; no light or white crescent on the chest. The light color across the shoulders is significant as will be shown further on.

Hair very coarse, with little under-wool.

Skull

	inches
Greatest length	16.0
Greatest width	9.25
Inter-orbital space	3.47
Greatest width of cranium	4.25
Greatest height of parietal ridge	1.5
Depth of muzzle	3.5
Width of muzzle	3.47
Length of lower jaw	11.0
Depth of lower jaw at posterior molar	2.25
Depth of lower jaw at angle	6.75
Width of palate	2.5

Teeth: Upper jaw, 3 molars, 2 premolars, 1 canine, and 3 incisors.
Lower jaw, 3 molars, 2 premolars, 1 canine, and 3 incisors.

This bear is a large animal, and owing to its high forehead, and deep muzzle and jaws, of a peculiarly savage appearance. In life the shoulders appear high.

Little is known of the habits of the species. The specimen I shot was very savage and tried repeatedly to attack me after receiving the first shot. The native Russians and Chinese greatly fear this animal, as it has been known to kill and devour hunters. They say it does not hibernate like the black bear. The stomach of my specimens contained nothing but acorns. The animal was estimated to weigh something over 600 lbs., but it was in very poor condition compared with what bears usually are in the autumn. It is known to the Chinese as *Hua Yao-tzu*, meaning 'pied kidneys.'

Habitat:—The range of this species probably extends throughout the forested areas of Manchuria and neighbouring regions. I heard of an animal that answered its description in South Kirin, North Corea, and on the Lower Sungari. Heude's specimen came from Tsi-tsi-har some distance to the north-west of Harbin in the valley of the Nonni Ho, in Dauria.

17. Spelæus piscator (Pucheran)

Ursus piscator PUCHERAN, Rev. Zool., 1855, p. 392.

Type:—No type; the species was based on a figure given by I. Geoffroy St. Hilaire in the *Zoology of the Voyage of the Venus, Mamm. t. 4*, as *Ursus arctos* var. du Kamschatka.

Locality:—Kamschatka.

Known as the Kamschatkan fish-bear, this species appears to belong to the cave-bear group rather than to the brown bears. A specimen assigned to this species that used to be in the gardens of the Zoological Society of London, and which I had the opportunity of examining at its death in 1918 reminded me very much of my specimen of *Spelæus cavifrons* in its general appearance. Its hair was softer, however, and of a dark brown color; the ears were full of long hair and were very hairy outside, much as in *U. isabellinus* and *U. pruinosus* of the Himalayas; while the forehead was not markedly high. The specimen was not very large, however, and had been kept in captivity a long time, so that the cranial characters are hardly to be considered. In any case the animal looked very different from typical members of the genus *Ursus*.

In 1867 Gray described a species of bear, *Ursus lasiotus* (*Ann. Nat. Hist. ser. 3. vol. 20, p. 301*) which was brought from China alive, and said to be from the interior of North China. Sclater (*P. Z. S. 1867, p. 818*), however stated that the animal probably belonged to *U. piscator* Pucheran, and from what we know of conditions then, the uncertainty attaching to the given locality of specimens from these parts, and the present distribution of this type of bear, it seems probable that Sclater was right. In any case *U. lasiotus* is unidentifiable at present.

18. Spelæus leuconyx (Severtzow)

Ursus leuconyx, Severtzow, Nachr. Ges. Moscou, vol. VIII, p. 79, pl. II, 1873
Type locality:—Altai Region.

This species appears to belong to the grizzlies, since it is described as having light claws, which is said to be characteristic of the latter group of bears. To it I refer some bears shot by the Fenwick Owen party in 1911 on the Kansu-Tibetan border. In spite of their somewhat light color these belong to the same group as the Manchurian *cavifrons*, if the photographs reproduced in Mr. Frank Wallace's book ("Big Game of Central and West China,") and others I have seen of them are to be relied upon. The adult specimens show the same high forehead, deep muzzle and jaws, and what is more significant a distinct light band across the shoulders; which it will be remembered occurs in an incipient form in *cavifrons*.

This also is a large species, and the specimens referred to above were said to be something like *U. pruinosus*. It is this fact, amongst

others, that makes me think it possible that the latter animal, and *U. lagomyiarius*, and possibly also *U. clarki* from the Ching Ling, may ultimately be found to be generically different from true *Ursus*, and possibly referable to *Spelæus*.

NOTES ON WOOD RAT WORK

By Edward R. Warren

[*Plates 10–11*]

While collecting at Alma, Park County, Colorado, in the autumn of 1914, I discovered some unusually interesting work of the "mountain rat," or Colorado bushy-tailed wood rat, *Neotoma cinerea orolestes*. This was in an old shafthouse on Buckskin Creek, about a mile from the town of Alma. While I have seen much of the work of this and other species of *Neotoma*, in some respects this was very different from any I have seen elsewhere. Whether the work of one or two of the animals I cannot say, though on one visit to the place I saw two.

The principal accumulation was about the shaft, which was toward the corner of the building, opposite the wide door shown in figure 1. This shaft was a two compartment affair, with manway and bucketway, the former open at the top, the latter covered with the usual sloping doors. About the shaft, but principally about the manhole, and even on top of the timbers, were piled many sticks. The pictures perhaps show better what a mass of stuff was there. The manway measured 30 inches square inside; an outside measurement could not be made, but the base of the pile was 48 inches on one side, and 45 inches on the other; the material was piled steeply, and much of it was green aspen leaves and twigs, just the tips of the branches. As these were often piled 12 inches high and 8 inches thick it will easily be seen that considerable labor was involved in gathering so much. While the accumulation was mainly about the manhole, it also extended somewhat along the bucketway, which was the same width, but a trifle longer.

The blacksmith forge in the shafthouse was on the same side of the building as the door previously mentioned, by the window which can be seen both in the picture of the building and in that of the forge. Here were more of the aspen leaves on the forge itself, on a ledge level with it, and on shelves and ledges above, five piles altogether. The

nest was on the topmost ledge. On the ledges with these aspen leaves, which, where thickest, were laid in regular layers, were also pieces of fungus from dead logs. The nest was the usual globular affair made of various fibers.

From an observation I made it seems possible that the leaves and fungus were food supplies for the winter. The following extract from my notebook may be of interest:

> When I went into the house the rat was on the ledge where the nest is, but went back into the nest. Did not seem much afraid. A few minutes after, when I was at the shaft, I saw two rats run along a ledge at the other end of the house and out onto the roof. Presently one came back and was fooling on the shelves at that end for several minutes, finally returning to the nest. I watched it climb about on the joists and boards and it seemed to be able to get a foothold almost anywhere. When I was all done with the photographic work and was examining things I stood on the forge and poked the nest with my finger. The rat came out and ran along the ledge, stopped four or five feet from me and apparently forgot all about me, for it began to eat something and fooled around for several minutes. I saw it have one aspen leaf in its mouth and am sure I saw it eat another. It presently came back to the nest while I stood there.

I remark in my notes that it may have been eating some of the fungus before I saw it with the aspen leaf. The altitude of the locality is about 10,300 feet, the winters are long with considerable snow, and foraging must be difficult at that season, so that it behooves a non-hibernating animal to lay in a good supply of food, and the rats seem to have availed themselves of the most convenient and accessible material. Elsewhere I have seen leaves of kinnikinnick brought into buildings and laid away much as the aspen leaves were, but have no evidence they were used as food. As a matter of fact I regarded it as a manifestation of the mania these animals have for carrying about useless articles.

Eight days after my examination of the work I paid another visit to the shafthouse as I was passing by. The pile at the manway appeared to have had additions made to it. Climbing upon the forge I poked the nest and the occupant came out, stopped hardly a foot away from me, and after a moment went back to the nest. When disturbed again it halted for a moment not far away and then went on out over the broken-down roof. A pile of sticks could be seen on the roof at the gallows frame of the shaft; it was inaccessible and could not be examined.

FIG. 1. SHAFTHOUSE, NEAR ALMA, COLO., IN WHICH THE WOOD RAT WORK WAS FOUND

The shaft was opposite the door at right end of house; the forge was by the window at the left. Sticks can be seen on the roof at the gallows frame.

FIG. 2. INTERIOR OF SHAFTHOUSE

Showing forge, with leaves piled on ledges above it, and nest on topmost ledge.

(Warren: Notes on Wood Rat Work.)

UNIV. OF MICH.

FIG. 1. ONE SIDE OF THE SHAFT SHOWING THE STICKS AND LEAVES PILED BY THE RATS

FIG. 2. OPPOSITE END OF SHAFT FROM MANWAY

Aspen leaves are to be seen here, and pine cones on top

(Warren: Notes on Wood Rat Work.)

UNIV. OF MICH.

On this same trip I found in another building, a large log cabin this time, two nests and various piles of sticks, among which were thistles and pieces of rose bushes. In a closet or small room in this house I found aspen leaves piled on the shelves in a manner similar to those in the shafthouse.

At Alma I heard a story of some miners who, having missed several pounds of candles, later found them laid away on a shelf or ledge in or behind the timbers 35 feet down a shaft, where a rat had carried them. As there are six candles to the pound the animal, or animals, went to much trouble for nothing.

AN INSULAR RACE OF COTTON RAT FROM THE FLORIDA KEYS

By Glover M. Allen

In April, 1920, Mr. Winthrop Sprague Brooks collected two adult cotton rats (*Sigmodon*) on Big Pine Key, Florida, which are so different from those of the neighboring mainland, that they seem worthy of recognition as representatives of a distinct island race. Through the generosity of Dr. Thomas Barbour, the specimens are in the collection of the Museum of Comparative Zoölogy to the authorities of which I am indebted for the privilege of studying them.

Big Pine Key is one of a group of small islands lying some thirty-five miles southwest of Cape Sable, the nearest point on the mainland of Florida. A chain of larger and smaller islands trends northeast from Big Pine to Key Largo and forms the eastward margin of the Bay of Florida. The other islands of the chain continue westward to the Dry Tortugas. These southern keys have no doubt been separated from the peninsula itself for a long period.

Due to the investigations of Messrs. F. M. Chapman and Outram Bangs, the cotton rat of the subtropical tip of the Florida peninsula has long been recognized as a well-marked geographical race,—*Sigmodon hispidus spadicipygus*,—readily distinguishable from the larger and darker races to the north,—*S. h. littoralis*, covering most of peninsular Florida, and *S. h. hispidus* of Georgia and the southeastern states. The new race needs comparison with the first-named only. It may be known as

Sigmodon hispidus exsputus[1] subsp. nov.

Type, adult male, skin and skull, 18,100 Mus. Comp. Zoölogy, from Big Pine Key, of the southern Florida Keys, collected April 16, 1920, by Winthrop S. Brooks.

General characters.—Small, about the size of *S. h. spadicipygus* but with a proportionally longer tail; at once distinguishable from the latter race by the general pale ochraceous tone of the dorsal surfaces of head and body, with slaty rather than blackish bases to the hairs, and the clearer white of the belly with the bases of the hairs less prominent and of a paler slaty gray.

Description.—General color of the dorsal surfaces pale "ochraceous buff," clearest along the sides of the cheeks and body, becoming slightly deeper on the rump. The long overlying hairs of the pelage on the lower half of the back are whitish tipped instead of black throughout as in the mainland form. The concealed bases of the hairs are slaty instead of blackish, and lack the indistinct brownish cast of *spadicipygus*. Belly nearly clear white, the color rather sharply marked off at the sides, the pale slaty bases of the hairs showing through but little, in contrast to the mainland form in which the transition from the color of the back to that of the belly is less sharp and the belly much tinged with brownish and slaty where the bases of the hairs show through. Fore feet above like the sides; the hind feet dusky with a sprinkling of dull-whitish hairs. Tail dusky, with short sparse hairs which are blackish above, faintly whitish below.

The skull is essentially as in *S. h. spadicipygus*, but a very little slenderer.

Measurements.—The collector's field record gives the following: total length 259 mm., tail 117, hind foot 33.5, ear 18.5. The skull measures: greatest length 36.5 mm., basal length 32, palatal length 28.5, nasals 15, upper tooth row 6, lower tooth row 6, zygomatic width 20.5, mastoid width 15.

Remarks.—In a series of twenty excellent skins from Cape Sable and Flamingo, collected in late March and early April and representing *spadicipygus*, there is but one (Bangs Coll. 4490 from Flamingo) that closely resembles the island race in its color. It is at once distinguishable, however, by its slightly brownish or rusty tint especially on the lower back, by the blacker bases of the hairs, and by its much shorter tail. In eighteen specimens of *S. h. spadicipygus* the collector's field measurements indicate that the tail averages 37 per cent (extremes 35 to 41) of the total length, whereas in the two island specimens it is much longer, 45 per cent in each, a difference at once obvious to the eye. Both specimens were shot by Mr. Brooks in the day time, while they were running actively about in the scrub.

[1] *exsputus*, cast out, banished, exiled.

DESCRIPTION OF A NEW SPECIES OF BEACH MOUSE FROM FLORIDA

By Arthur H. Howell

The group of mice typified by the oldfield mouse (*Peromyscus polionotus*) is a plastic group, occupying a rather limited area in Georgia, Alabama, and Florida, but splitting into a number of well-marked forms. In the interior these mice live chiefly in sandy fields, either cultivated or uncultivated, and on the coast occupy the sandy ocean beaches where the vegetation consists chiefly of sea oats (*Uniola* sp.) and scattering clumps of bushes.

In Florida, five forms are at present recognized, four on the mainland and one on Anastasia Island (opposite St. Augustine). Osgood[1] gives all of them the rank of subspecies and (with the possible exception of *phasma*) this seems to be the logical course, but too little collecting has been done to permit of defining exactly the ranges of the various races. In general, however, we know that typical *polionotus* occupies southern Georgia, the greater part of eastern Alabama, and extreme northern Florida; *niveiventris* is apparently confined to the ocean beaches on the Atlantic coast from Hillsboro Inlet north to Mosquito Inlet; *rhoadsi* occupies the western side of the peninsula in the region north of Tampa Bay and possibly ranges most of the way across to the Atlantic side, probably intergrading with both *niveiventris* and *polionotus; albifrons* is known from the region around Choctawhatchee Bay, extreme western Florida, and from the ocean beaches in southeastern Alabama east of Mobile Bay; *phasma* is confined to Anastasia Island.

The discovery of a strikingly marked new species on Santa Rosa Island—a narrow sandy island about 50 miles long extending from the mouth of Pensacola Bay to the mouth of Choctawhatchee Bay—is rather surprising and of great interest. The island is separated from the mainland only by a shallow bay, in places not over a quarter of a mile wide but the species living on the island is totally unlike the form found on the nearby mainland. It is by far the palest form in the group and, unlike the races occupying the beaches of eastern Florida, is of a drab rather than a buffy tone.

The form occupying the mainland opposite Santa Rosa Island—*albifrons*—ranges also, as has been stated, over the Gulf beaches of

[1] Osgood, W. H., N. Am. Fauna no. 28, pp. 104–109, 1909.

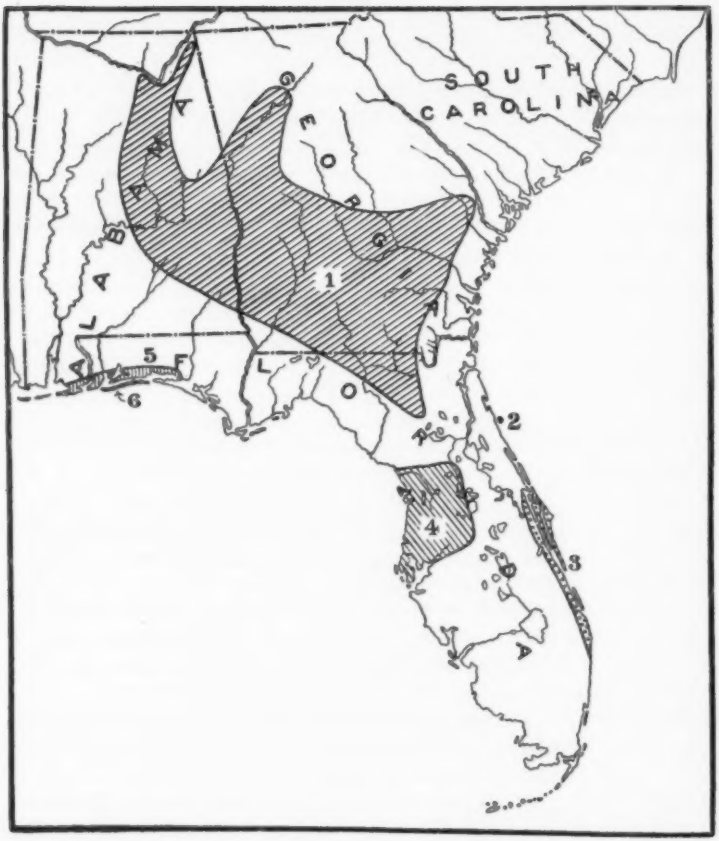


FIG. 1. PROVISIONAL MAP OF THE DISTRIBUTION OF THE OLDFIELD AND BEACH MICE *Peromyscus polionotus* group

1, Peromyscus polionotus polionotus; 2, Peromyscus p. phasma; 3, Peromyscus p. niveiventris; 4, Peromyscus p. rhoadsi; 5, Peromyscus p. albifrons; 6, Peromyscus leucocephalus nobis.

southeastern Alabama where the conditions are practically the same as on Santa Rosa Island, but the series from the Alabama beaches is practically the same as the type series from the north side of Choctawhatchee Bay (Whitfield, Florida).[2] The strip of beach in Alabama where the mice occur extends from the mouth of Perdido Bay westward to the mouth of Mobile Bay (the specimens being labelled "Bon Secour" and "Orange Beach"); there is direct connection between the beach and the mainland. We have, therefore, in the case of *leucocephalus* a striking illustration of the effect of isolation in perpetuating color variations, and in the case of the Alabama representatives of *albifrons* the inadequacy of a peculiar environment apart from isolation to produce similar changes.

Peromyscus leucocephalus sp. nov.

WHITE-HEADED BEACH MOUSE

Type, No. 234,358, U. S. Natl. Mus., Biological Survey collection; ♀ adult, skin and skull, from Santa Rosa Island, opposite Camp Walton, Florida; collected February 26, 1920, by A. H. Howell; original number 2392.

Specific characters.—Similar to *Peromyscus polionotus phasma* but color tone of upperparts drab instead of buff; colored dorsal area narrower, the whole of the sides white; entire head and face, except crown, white; paler, more extensively white, and slightly larger than *Peromyscus p. albifrons*. Skull similar to that of *phasma*, larger than that of *albifrons*.

Description of type.—Dorsal area, occiput, and crown light drab; rest of head, face, sides, underparts, and limbs white (the hairs white to base); ears whitish at base, becoming mouse gray at tips; tail unicolor, white, with a faint tinge of drab.

Measurements.—Type: Total length, 140; tail vertebræ, 51; hind foot, 18.5; ear from notch (dry), 11; average of 10 adults from type locality, 128.3; 48.4; 18.2; 10.9. *Skull* (of type): Occipito-nasal length, 23.6; zygomatic breadth, 12.3; interorbital breadth, 3.6; length of nasals, 9.1; maxillary tooth row, 3.5.

Remarks.—This new mouse is abundant on Santa Rosa Island and apparently is very similar in habits to the other beach mice of this group. Its tracks and trails are seen everywhere among the sparse growth of sea oats on the ridge of dunes close to the beach and numerous small burrows evidently made by the mice are found in the face of the sand hills. A considerable number of the burrows were opened with a shovel but none of the mice could be dislodged. Most of

[2] They average slightly paler (less brownish) on the back than typical *albifrons* but the heads are no more whitish.

the burrows were shallow, but one was found to extend for a distance of five feet into the perpendicular face of a hard sand hill. This burrow was about an inch in diameter and inclined slightly upward from the entrance. At the terminus of the burrow was a small, flat nest of dead grasses and a little pile of shelled pods of a wild pea (*Galactia* sp.). Another burrow was about three feet long and contained a similar nest and pile of pea pods.

GENERAL NOTES

ATTACKED BY A COUGAR?

In February last, during a short expedition in Venezuela, I had an interesting encounter with a cougar which seems worth relating as a possible addition to the rather scanty evidence that this animal does not always flee from man. The incident occurred in the foothills of the Sierra de Perijà near the Rio Cogollo, some eighty miles southwest of the city of Maracaibo. This locality is on the frontier of the region held by the hostile Motilone Indians and therefore little frequented and practically in virgin condition.

At about ten o'clock one morning, after visiting a short line of traps and spending several hours hunting for deer, I started to backtrack toward camp, following in general the same fairly marked deer trails over which I had just passed. Although the forest was rather thin, passage was impeded by light but much entwined underbrush except on these trails or in occasional small grassy openings suggestive of the extensive savannas lying a few miles eastward. At a turn in the trail and on the crest of a wooded knoll, when I was halfway to camp, feeling the heat of the powerful sun, passing a spot previously reconnoitered carefully for deer, and hence not so alert as before, I was suddenly confronted by what to my astonished eyes seemed the largest cougar that ever grew. It started from behind some low bushes at my left and fifty feet, or at most sixty feet, in front of me. I did not see it rise, but it gave the impression of having been lying down. The forest was rather scraggly at this point and the trail I was following was dissolved in several small openings, in one of which the animal appeared, so the sensation of meeting it directly in the trail was lost. It started toward me immediately, growling savagely, its eyes blazing, tail lashing, and if there was any indication that it did not intend to make away with me, I failed to recognize it. It did not come on the run, however, and whether it would have done so or not I cannot say, for its long feline strides were so full of determination I did not care to await developments but promptly fired a load of buckshot full into its face. It dropped instantly and rolled behind some small bushes which prevented me from firing the second barrel. I had a flash of elation, but the glowering visage was still uppermost in my mind; so, instead of running in with my other barrel, I prudently stopped to reload the one already fired and while the gun was open the cougar rose and disappeared in a dense thicket leaving scattered drops of blood and a trail which I could not follow far without dogs. Failure to kill the beast of course caused considerable chagrin, but the unique experience was some consolation.

Both the appearance of the cougar in the daytime and its failure to run at first sight of a man are probably accounted for by the wildness of the region. Although human habitations are not far to the eastward, there are many square miles to the westward never traversed by white men and, although wild tribes still occupy some parts, there are many very large areas from which they too are absent. It is not impossible, therefore, that this cougar had never before seen a human being. This is perhaps less likely than that it had been following my trail, as it had that of other humans and, upon my sudden appearance, felt cornered, so advanced instead of retreating. At any rate, there is at least one person who is sufficiently convinced that some cougars under some circumstances may be far from cowardly. —*W. H. Osgood.*

THE JAGUAR IN COLORADO

Is this an additional jaguar record for the United States and a new mammal for Colorado? Rufus B. Sage, while camped on Soublet's Creek at the base of the Rockies, head waters of the Platte, within 30 or 40 miles of Long's Peak and 2 days' march from Fort Lancaster, in December of 1843, says: "One of our party encountered a strange looking animal in his excursions, which from his description, must have been of the Leopard family. This circumstance is the more remarkable, as Leopards are rarely found except in Southern latitudes. However, they are not infrequently met in some parts of the Cumanche country, and their skins furnish to the natives a favorite material for arrow-cases." (Rocky Mountain Life, p. 347.) As Sage was quite familiar with panthers and bobcats this may have been jaguar or ocelot.

—*Ernest Thompson Seton.*

DIURNAL NEST-BUILDING BY A WOOD RAT

Wood rats are usually considered nocturnal, or at least nocturnal and crepuscular, in their habits. On the W Triangle Ranch, near the head of Cataract Canyon, 12 miles west-southwest of Anita, Arizona, one was observed at 5:10 p.m., September 19, 1916, building a nest in a cavern among the rocks. The animal was first seen carrying *Gutierrezia* stems from just outside the entrance of the cavern, where it had apparently stored a small supply. It made two trips to this little pile, which was about 8 feet from the nest, gathered 5 or 6 stems in its mouth, and carried them to the nest, where it worked assiduously placing them with its mouth and fore-feet. After I had watched it for 5 minutes, it discovered me and hid its head behind a rock, and,—ostrich-fashion—seemed to think it was hidden. A slight movement on my part and it disappeared into a hole among the rocks back of the nest. When the rat was first observed she was exposed to direct sunlight which entered that part of the nest upon which she was working. And when she was trying to hide, though still visible, in the interior of the cavity, she was in diffused daylight—by no means in darkness.

The basal and external parts of the nest consisted of sticks (largely the woody part of *Atriplex* and *Gutierrezia*) and a smaller portion of pieces of cactus (mostly *Opuntia* and *Echinocereus*), which formed a semicircle around the anterior (near

the cavern entrance) part of the nest. Within this was a circle of coarse stems and leaves of *Gutierrezia*, inside of which was the nest proper, composed of fine plant-fibres and grama grass. The entire nest, sticks and all, was about 2⅔ feet long (length extending *into* the cavern) and 1½ feet wide (*across* the cavern). The part composed of plant fibre and grass was externally 8 inches in diameter, and internally (nesting cavity) 6 inches in diameter. The nesting cavity was 3 inches deep and entirely open above, evidently in process of construction.

My stay in this region was limited, so in order to be certain of the identity of the little nest-builder a Schuyler rat trap was set on the nest proper. Upon my return one-half hour later (5:45 p.m.) a female *Neotoma albigula albigula* (No. 215645, Biological Survey collection, United States National Museum) was in the trap. She had moderately developed mammæ but contained no embryos.

—*Hartley H. T. Jackson.*

A SECOND RECORD OF PHENACOMYS ALBIPES IN CALIFORNIA, WITH A DISCUSSION OF THE SPECIES

On July 11, 1919, the writer secured a young but apparently breeding female of *Phenacomys albipes* three miles north of Orick, Humboldt County, California, which specimen constitutes the second record of the species for the state. It was taken in an oat-baited trap under a log-jam near the bank of a stream which flows through dense redwood and maple forest. This individual does not fully agree with published descriptions, so S. W. Jewett kindly loaned me for comparison three specimens of this species from his own collection, and one belonging to the Oregon Fish and Game Commission. I was also generously permitted to examine the type of *albipes*, in the collection of the Bureau of Biological Survey. Indications point to the fact that most of the cranial differences shown by my specimen may be accounted for by its age, which is less than that of the others. However, it varies individually in having narrower incisive foramina with posterior constriction, and a slightly different enamel pattern.

As the six specimens of *P. albipes* before me are more than have ever been available for study heretofore, it seems desirable to put on record some of the *average* characters of the species as indicated by this series. I find that the feet of the type are the palest of any in the lot; they are of a pronounced grayish cast, and not pure white as in *P. orophilus*. The ears of the Orick example are covered with black hairs, while in the other five these members are almost naked. As with most other microtines, the enamel pattern of the molariform teeth varies considerably within certain limits, and one must be careful not to give equal weight to all dental differences. The enamel pattern of the upper teeth is rather constant in the five skulls of *albipes* at hand (the sixth is too old, worn, and broken to be of much value in this connection). In the case of the lower teeth, M_1 of the type is unusual in having the outer triangles very irregular in position and size; while, in the other four, these are quite uniform. The Orick specimen is peculiar in having the anterior trefoil of M_1 with the outer loop situated entirely posterior to the other two. In two specimens there is a tendency for the antero-external loop of M_2 to open. Normally, in M_3 there is a slight constriction in the enamel fold near the external end of the middle digitation, but in the Orick skull this is developed into a pronounced, though small, outer triangle.

After studying the California species of *Phenacomys*, I can see nothing to be gained by adopting the subgenus *Arborimus* Taylor. Most of the characters on which it is based are either very slight, or inconstant. It seems to me that the genus is an unusually well-defined one, and that nothing whatever can be gained by further division. However, if a subgenus *must* be recognized, let it contain only *longicaudus*, and be based upon the arboreal habits and hairy tail of that species, rather than on ill-defined characters that can be segregated only with considerable difficulty.

—*A. Brazier Howell.*

NOTES ON FLYING SQUIRRELS AND GRAY SQUIRRELS

It does not seem to be generally known to lovers of the out-doors that the flying squirrel is well distributed over a large area of the United States and Southern Canada. On March 27, while taking a walk in the woods of the bluffs of the Mississippi River, I tapped a dead poplar tree which looked to me as if the cavity in it might be the home of a flying squirrel. Within a few seconds, a flying squirrel did come out of the hole, but it was evidently very reluctant to leave its comfortable nest. It ran to the other side of the tree, entered by another hole and came out of the first hole again. This it did five times. My friend and I thought at first that we had discovered the home of a whole family of squirrels, but soon discovered that the little creature had been fooling us on the census. At last it climbed up to the top of the dead tree and then disappeared in the top of a live basswood to the right.

We returned to the same tree in about half an hour and again, by tapping the nest tree gently with a stick, induced the squirrel, which by this time had returned, to come out. On this occasion it uttered a rat-like squeak as it climbed up on the other side of the tree and again made for the top of the basswood. From that position it glided away about sixty feet to the bottom of another tree lower on the slope, gracefully clearing any of the intervening branches. On the 1st of April, I again visited the place. This time I had a camera with me and although I found it rather difficult to drive out the squirrel, and also take a picture, I succeeded in getting one fair photograph. The squirrel again had to be driven out several times before he finally left the nest and disappeared in the top of the basswood.

On April 10, I took a walk through the same woods and discovered in a scarlet oak tree near a field and a pasture, one of the well-known leafy squirrel nests about twenty feet up. The nest looked quite fresh and, when a friend tapped the tree with a stick, a large gray squirrel came out, apparently quite reluctant to leave the nest. As neither of us was dressed for climbing trees, we left the place without examining the nest. The next day, I returned and climbed the tree. I found the nest a very well-built, compact structure with a small entrance on the southwest side near the top. In the nest were four young. Although it had rained quite a little on the preceding day and for several hours during the night, the nest which was lined with very fine, soft grass, was perfectly dry, the structure being apparently rain proof. I took the young out, carried them down in my hat, covering them up carefully, and photographed them.

The backs were covered with very short gray hair, the bellies were still almost naked and had a pinkish appearance, the tails looked like rat tails and were about as long as the bodies and were covered with a very short growth of hair. The animals were about four inches and a half long, and their eyes were still closed. If they had had short tails, they would have resembled young bull pups very closely. They crawled about very much like young pups and kittens. The mother we did not see on this occasion. After photographing the young, my companion returned them to the nest. On both occasions, when they were taken out and when they were returned, they utttered a sharp squeak, which I could plainly hear with the wind at a distance of seventy-five yards.

I judge that the four young together weighed nearly as much as an adult gray squirrel. The nest was perfectly clean and dry, with no droppings or smell of urine about it, and I have wondered a good deal how the animals managed to keep it so clean. The young were apparently about a week or ten days old, which would mean that they were born about the first of April. We have had steady cold weather through the winter, including the first half of March, and only the last few days have been warm and spring-like. I was rather surprised to find the young squirrels in a nest of leafy twigs. I had the idea that they were generally born in a hollow tree. Possibly some of the readers of the Journal can give further information on both flying squirrels and gray squirrels.

The wooded strips of broken bluffs that line all our plains rivers are ideal resorts for small game animals and for song birds and game birds, and I think members of the society should endeavor to have game refuges established on land of this kind all over the country, where young and old can get glimpses of our interesting wild birds and animals. The strip of woods which I refer to extends about ten miles on the west bank of the Mississippi north from the town of Hastings toward St. Paul. The land is under cultivation to the edge of the bluffs, but the bluffs are too rough for cultivation, and the river bottom, from a mile to a mile and a half wide, is flooded during periods of high water, and is occupied by marshes, lakes and strips of river-bottom timber, including cottonwoods, soft maples, white ash, hackberry, and elm.

—*D. Lange.*

Mechanic Arts High School, Saint Paul, Minn.

DATES OF SHEDDING OF HORNS

Below are the dates on which examples of some of the species of deer, and the American antelope, dropped their horns in the National Zoological Park at Washington, D. C., during the season of 1919–1920.

Barasingha deer (*Rucervus duvaucelii*)	December 13; January 29
Prong-horned antelope (*Antilocapra americana*)	December 23
Virginia deer (*Odocoileus virginianus*)	January 25, 27, and 29
Black-tailed deer (*Odocoileus columbianus*)	January 26
Mule deer (*Odocoileus hemionus*)	February 24
American elk (*Cervus canadensis*)	March 3
European red deer (*Cervus elaphus*)	March 23
Japanese deer (*Sika nippon*)	March 31
Kashmir deer (*Cervus hanglu*)	April 8

Fallow deer (*Dama dama*).....May 3
Sambar (*Rusa unicolor*).....June 18
Hog-deer (*Hyelaphus porcinus*).....July 8

It would be interesting to have dates from other zoological gardens, both in America and Europe, for comparison.

—*N. Hollister.*

RECENT LITERATURE

Hall, Harvey Monroe, and Joseph Grinnell. LIFE-ZONE INDICATORS IN CALIFORNIA. Proc. California Acad. Sci., ser. 4, vol. 9, no. 2, pp. 37–67. June 16, 1919.

Few devices for handling the data of geographic distribution of animals or plants have been more useful than the life-zone. For satisfactory zonal diagnosis of a given locality it has usually been necessary to make an exhaustive study of the entire fauna and flora. To obviate this necessity, so far as California is concerned, is the hope of the authors of this paper, who proceed to list certain critical species of plants, amphibians, reptiles, birds, and mammals as life-zone indicators.

Almost at the outset the importance of recognizing local modifying factors is emphasized. Those considered are slope exposure, air currents, streams carrying cold water, evaporation from moist soil, proximity to large bodies of water, influence of lingering snow banks and of glaciers, changes in vegetal covering, extent of a mountain area, rock surfaces, miscellaneous local influences.

Five criteria are given as among those used in the selection of the life-zone indicators. Briefly stated these are (1) Only breeding records have been taken into account. (2) In plants perennials are usually preferred to annuals. (3) The more abundant a species the greater its value as an indicator. (4) A particular indicator, though constant in zonal position in one portion of its range may be unreliable when its entire range is considered, due "perhaps to the possible development of hardy strains in one portion of the range and not in another," or to some other cause. Furthermore, biotypes, similar in external characters but reacting differently to their environment, may escape detection by the taxonomist. (5) So far as possible, indicators listed by C. Hart Merriam are used, since the authors in the main accept his delimitation of the life-zones.

The lists of mammalian indicators include: For the Lower Sonoran, 78 forms belonging to 34 genera; Upper Sonoran, 48 forms, 18 genera; Transition, 27 forms, 14 genera; Canadian, 30 forms, 15 genera; Hudsonian, 7 forms, 5 genera. No mammals, reptiles or amphibians are listed for the Alpine Arctic, the sole indicator aside from plants being the rosy finch, *Leucosticte tephrocotis dawsoni*. It so happens that among the animals listed there are more mammalian indicators than bird, reptile, or amphibian for each zone except the Transition (which has three more bird indicators than mammalian) and the Alpine Arctic.

The paper will be of interest to every student of the distribution of the higher vertebrates of the western states.

—*Walter P. Taylor.*

Fitzsimons, F. W. THE NATURAL HISTORY OF SOUTH AFRICA. MAMMALS. Vol. I, pp. i–xix, 1–178, 51 plates; Vol. II, pp. i–xi, 1–195, 48 plates. London; Longmans, Green and Co., 1919.

The director of the Port Elizabeth Museum has given us a much needed work on the life-histories of the mammals of a region of very great interest. Based on long years of actual observation, his accounts of the various species, many of which are rapidly disappearing before the advance of settlement, are of more than usual completeness, and are presented in an entertaining style. The first volume includes the primates, bats, and Felidæ; the second contains accounts of the Viverridæ, the aard-wolf, hyenas, Canidæ, Mustelidæ, and the Cape sea-lion. A systematic index precedes and an outline of classification of the forms dealt with closes each volume. The main body of the text is decidedly popular and some of the biographies are extensive, that of the chacma including 40 pages. Well-selected anecdotes, usually based on first-hand experiences, help to complete the pictures of the homes, lives, and characteristics of the animals. The author's keen sympathy with wild creatures is evident throughout the work; extermination apparently necessary is deplored, and useless killing is condemned. The classification adopted, while in the main modern, is, in one place, curiously antiquated; the bat genera *Taphozous*, *Nyctinomus*, *Mormopterus*, and *Chærephon* being included in the family Vespertilionidæ. It is to be regretted that the International Code has not been followed strictly in the selection of names. In works for popular use these matters often are slighted, but there, if anywhere, they should be painstakingly correct; and differences in opinion might well be explained. It is presumed that the remaining volumes will include the rodents and ungulates, and naturalists interested in the wondrous animal life of South Africa will look forward with pleasure to their appearance.

—*N. Hollister.*

Rathbun, Mary J. REPORT OF THE CANADIAN ARCTIC EXPEDITION, 1913–18. VOL. VII: CRUSTACEA. PART A: DECAPOD CRUSTACEANS. Southern Party—1913–16, pp. 1–14D. Ottawa, August 18, 1919.

In this paper Miss Rathbun, listing the decapod crustaceans collected by the expedition, identifies the following species taken from the stomachs of the bearded seal, *Erignathus barbatus* (Erxleben), and common rough seal, *Phoca hispida* Schreber:

Spirontocaris grœnlandica (J. C. Fabricius) from *E. barbatus*.
Spirontocaris spina (Sowerby) from *P. hispida* and *E. barbatus*.
Spirontocaris phippsii (Krøyer) from *E. barbatus*.
Spirontocaris polaris (Sabine) from *E. barbatus*.
Sclerocrangon boreas (Phipps) from *E. barbatus*.
Sabinea septemcarinata Sabine from *E. barbatus* and *Phoca fœtida* (*hispida*).

—*R. M. Anderson.*

Dall, William Healey. REPORT OF THE CANADIAN ARCTIC EXPEDITION, 1913–18. VOLUME VIII: MOLLUSKS, ECHINODERMS, COELENTERATES, ETC. Part A: MOLLUSKS, RECENT AND PLEISTOCENE. Southern Party—1913–16, pp. 1–30A. Ottawa, September 24, 1919.

In this paper Dr. W. H. Dall, honorary curator of mollusks, United States National Museum, in describing the mollusks collected by the expedition, iden-

tifies the following species taken from the stomachs of bearded seal, *Erignathus barbatus* (Erxleben), taken at Bernard harbour, Dolphin and Union Strait, Northwest Territorities: *Margarites helicinus* Fabricius, *Musculus lævigatus* Gray, *Saxicava arctica* Linné, *Cylichna* sp. (fragment), opercula of *Buccinum* sp. indet., ovicapsules of *Buccinum* sp., *Utriculus* sp. (fragments), *Margarites sordidus* Hancock (fragments), molluscan egg capsules, egg capsules of unknown gastropods.

—*R. M. Anderson.*

Anthony, H. E. A zoölogist in Jamaica. Nat. Hist., vol. 20, pp. 156–168. March–April, 1920. (Interesting account of the living and extinct mammals.)

Bolk, L. Das Haarkleid eines Fetus von Schimpanse. Bijdragen tot de Dierkunde, Amsterdam, vol. 20, Feest-number, pp. 57–65, with 8 figs. Leiden, 1919.

de Lange, Dan., Jr. Contribution to the knowledge of the placentation of the Cape goldmole (Chrysochloris). Bijdragen tot de Dierkunde, Amsterdam, vol. 20, Feest-number, pp. 165–173, pls. 4–7. Leiden, 1919.

Dexter, John S. Albino vertebrates. Science, n. s., vol. 52, pp. 130–131. August 6, 1920. (Record of albino *Citellus richardsoni* from Saskatchewan.)

Dreyer, W. Vejleder i Zoologisk Have. Pp. 1–72; many figs. Kjöbenhavn, 1920. (Guide to the Copenhagen zoological gardens for the spring of 1920. According to the annual report, which arrived in the same mail, the collection contained on January 1, 1920, 365 mammals of 124 species.)

Earnshaw, Frank L. See Lawyer, Geo. A., and Frank L. Earnshaw.

Flower, S. S. Report on the Zoological Service for the year 1919. In which is included the 21st annual report of the Giza Zoological Gardens. Ministry of Public Works, Egypt, pub. no. 31, pp. 1–26. Cairo, 1920.

Gidley, James Williams. Pleistocene peccaries from the Cumberland cave deposit. Proc. U. S. Nat. Mus., vol. 57, pp. 651–678; figs. 1–13; plates 54–55. 1920. (Revised definitions for the families Suidæ and Tayassuidæ, and the genera of peccaries. Describes two new species each of *Platygonus* and *Mylohyus*.)

Harrison, H. S. The ascent of man: a handbook to the cases illustrating the structure of man and the great apes. The Horniman Museum and Library no. 13, pp. 1–74. London County Council, 1920.

Hinton, Martin A. C. The Irish otter. Ann. and Mag. Nat. Hist., ser. 9, vol. 5, p. 464. June, 1920. (Revives the name *Lutra roensis* Ogilby, 1834; and recognizes the otter of Ireland as a subspecies of *L. vulgaris*.)

Hinton, Martin A. C. The species of *Pedetes* inhabiting Angola. Ann. and Mag. Nat. Hist., ser. 9, vol. 6, pp. 102–104. July, 1920. (*Pedetes angolæ* sp. nov.)

Hinton, Martin A. C. Three new mammals from northern Rhodesia. Ann. and Mag. Nat. Hist., ser. 9, vol. 6, pp. 239–242. August, 1920. (Describes *Mimetillus thomasi*, *Kerivoula lucia*, and *Zelotomys shortridgei*.)

HINTON, MARTIN A. C., AND P. S. KERSHAW. On a collection of mammals from the Dinka country, Bahr-el-Djebel. Ann. and Mag. Nat. Hist., ser. 9, vol. 6, pp. 94–101. July, 1920. (New: *Taterona benvenuta, T. b. lucia,* and *Acomys wilsoni argillaceus.*)

HORNADAY, WILLIAM T. The rescued seal industry. Science, n. s., vol. 52, pp. 81–82. July 23, 1920. (Five-year close season justified. 9100 skins sold in February, 1920, by government, net proceeds of which were $1,182,905.)

HOWELL, A. BRAZIER. A study of the California jumping mice of the genus Zapus. Univ. California Publ. Zool., vol. 21, pp. 225–238, 1 text fig. May 20, 1920. (Describes one new form, *Zapus trinotatus eureka,* from Fair Oaks, Humboldt County, California.)

JORDAN, DAVID STARR. The fur seals. Science, n. s., vol. 52, p. 255. September 3, 1920. (Regards the recent five years closed season as "absurdly needless.")

KERSHAW, P. S. See Hinton, Martin A. C., and P. S. Kershaw.

KLOSS, C. BODEN. On mammals collected in Siam. Journ. Nat. Hist. Soc. Siam, vol. 3, pp. 334–407, pls. 7–8. December 31, 1919. (Report on 340 specimens collected in 1916. New forms include *Presbytis argenteus, P. cristata koratensis, P. germaini changensis, Macaca nemestrina indochinensis, M. irus atriceps, Viverricula malaccensis thai, Tupaia glis cambodiana, T. g. olivacea, Tamiops macclellandi liantis, Menetes berdmorei peninsularis, Rattus rajah koratis, R. r. kramis, R. rattus lanensis, R. r. kramensis, R. r. mesanis, R. r. koratensis, Bandicota siamensis,* and *Capricornis sumatraensis annectens.*)

KURODA, NAGAMICHI. On a collection of Japanese and Formosan mammals. Annot. Zool. Japonensis, vol. 9, part 5, pp. 599–611. 1920. (Describes *Nyctalus noctula namiyei,* subsp. nov., from Otsukuejima, on the coast of Chikuzen Province, Kiusiu, Japan.)

KURODA, NAGAMICHI. On two rare species of Muridæ from the Central Mountains of Formosa. Dobutsugaku Zasshi, vol. 32, pp. 36–43, figs. 1–2, 1920. (Describes *Microtus kikuchii,* sp. nov., from 10,000 feet altitude on Mount Morrison, Formosa; and records two specimens of *Rattus culturatus* Thomas from the same locality.)

LANG, HERBERT. The white rhinoceros of the Belgian Congo. Zool. Soc. Bull., vol. 23, pp. 67–92, numerous half-tone figs. July, 1920. (General account of the animal, its habits, physical features, distribution, habitat; with experiences of the author while collecting specimens for the American Museum of Natural History.)

LAWYER, GEO. A., AND FRANK L. EARNSHAW. Game laws for 1920. A summary of Federal, State, and Provincial statutes. U. S. Dept. Agric., Farmers' Bull. 1138, pp. 1–84. August, 1920.

MILLER, GERRIT S., JR. American records of whales of the genus Pseudorca. Proc. U. S. Nat. Mus., vol. 57, pp. 205–207, pls. 27–31. June, 1920. (Specimens from Peru, Lower California, Venezuela, and Florida.)

MOORE, CARL R. The production of artificial hermaphrodites in mammals. Science, n. s., vol. 52, pp. 179–182. August 20, 1920.

MURPHY, ROBERT CUSHMAN. The seacoast and islands of Peru. I. Brooklyn Mus. Quart., vol. 7, pp. 69–95, 6 figs. April, 1920. (Includes discussion of the relation of ocean currents to the distribution of pinnipeds and other marine vertebrates. Maps show range of fur-seals, sea-elephants, and sea-lions.)

NEW YORK ZOOLOGICAL SOCIETY. Twenty-fourth annual report. 1919. Pp. 1–204, numerous illustrations. January, 1920. (On December 31, 1919, the collection of living animals at the New York Zoological Park included 591 mammals of 173 species.)

OBERHOLSER, HARRY C. The nomenclature of families and subfamilies in zoology. Science, n. s., vol. 52, pp. 142–147. August 13, 1920. (Tentative rules for the determination and treatment of family and subfamily names.)

SHUFELDT, R. W. Tramps through the Gulf States—I. Amer. Forestry, vol. 26, pp. 489–496. August, 1920. (Photographs of the Texas armadillo.)

SUMNER, FRANCIS B. The need for a more serious effort to rescue a few fragments of vanishing nature. Sci. Monthly, 1920, pp. 236–248. March. (A plea for permanent reservations for wild life that will preserve truly natural conditions.)

SUMNER, FRANCIS B. Geographic variation and Mendelian inheritance. Journ. Exper. Zoöl., vol. 30, pp. 369–402; figs. 1–7; tab. 1–4. April, 1920. (Interesting experiments with different geographical races of California *Peromyscus*.)

THOMAS, OLDFIELD. New species of *Reithrodon*, *Abrocoma*, and *Scapteromys* from Argentina. Ann. and Mag. Nat. Hist., ser. 9., vol. 5, pp. 473–478. June, 1920.

THOMAS, OLDFIELD. *Notoryctes* in North-west Australia. Ann. and Mag. Nat. Hist., ser. 9, vol. 6, pp. 111–113. July, 1920. (Describes a new species, *N. caurinus*.)

THOMAS, OLDFIELD. A new genus of Echimyinæ. Ann. and Mag. Nat. Hist., ser. 9, vol. 6, pp. 113–115. July, 1920. (*Lonchothrix emiliæ* gen. et spec. nov., from Rio Tapajoz, Brazil.)

THOMAS, OLDFIELD. On mammals from near Tinogasta, Catamarca, collected by Sr. Budin. Ann. and Mag. Nat. Hist., ser. 9, vol. 6, pp. 116–120. July, 1920. (New: *Octomys*, type *O. mimax* sp. nov.; and *Ctenomys coludo;* both from Argentina.)

THOMAS, OLDFIELD. A new tuco-tuco from Tucuman. Ann. and Mag. Nat. Hist., ser. 9, vol. 6, pp. 243–244. August, 1920. (Describes *Ctenomys occultus* from Tucuman Province, Argentina.)

WILLOUGHBY, CHARLES H. Beavers and the Adirondacks. Conservationist, vol. 3, pp. 67–70. May, 1920. (Beavers introduced from Yellowstone Park and other localities have restocked this region, where it is now estimated there are between 15,000 and 20,000 animals.)

EDITORIAL COMMENT

Many of those who heard Mr. Vernon Bailey's talk on "Modern methods in mammalogical field work," at the New York meeting of the Society last May, expressed the intention of capturing some small mammals for home vivariums. Doubtless most of these, like the writer, neglected to do so. But when Mr. Bailey departed on an extended field trip in July, he left in the editor's office an assortment of small cages containing field mice, deer mice, and pocket mice of various species. Before one day was gone it became apparent that these little creatures were going to be very interesting indeed, and they have since proved highly entertaining and instructive as well. The little pocket mice of the genus *Perognathus* are especially admired, as they can be handled at pleasure; but the commoner forms of *Peromyscus* and *Microtus*, although less gentle and confiding, are no less fascinating subjects for a cage on the study table. The editor can now recommend to all mammalogists the substitution of small furred animals for the conventional canary or goldfish.

Members of the Society are urgently requested to look over carefully the list of members which appeared in the last number. Many persons who should affiliate with the Society have doubtless not as yet had the matter brought to their attention, and a little effort will doubtless add several hundred names to the membership roll of the Society. The Journal could be greatly enlarged and improved by an increased revenue.

The actual date of publication of the preceding number of the Journal of Mammalogy (vol. 1, no. 4) was August 24, 1920.

The *National Humane Review* for May, 1920, makes the statement that "zoos and menageries are survivals of that Roman civilization which perished under practices of cruelty, selfishness, cupidity and immorality, and these qualities are actively disclosed now in our own civilization by our approval and patronage of wickednesses which helped wreck the Romans;" and, further along, that "zoos and menageries are essentially barbaric," and that the training of wild animals almost always results in "diabolical cruelty."

It is unfortunate that a great organization like the National Humane Society, which is doing so much good in some ways, should adopt an attitude of hostility to the zoological garden, when it ought to give such institutions its cooperation and help. Of course the statements quoted are not to be taken seriously; a magazine devoted to reform must be in a measure sensational. The zoo is a survival of the Roman civilization, it is true; but so is the school, the art museum, and the public bath. The zoological garden idea is much older than the Romans; the ancient Egyptians kept collections of wild animals, as doubtless did still earlier peoples, far back of all record. Well-conducted zoological gardens offer great educational and recreational advantages, which are being more and more appreciated, and new zoos are now being established in cities throughout the world. They are very popular—much more so than most other educational establishments—and because they appeal to a vast number of people they are able, unquestionably, to do a great deal of good. Approximately two

million people annually visit the New York Zoological Park and the National Zoo in Washington. A total attendance of 2,229,605 was recorded for the year ending June 30, 1920, at the latter establishment. This does not necessarily imply that there are that many "barbarians" among the people of Washington or the visiting tourists, for some of the enthusiasts visited the zoo at least once a week during the year; some of the most interested went oftener.

The modern zoological garden is conducted on a much higher plane than was the ancient animal collection. There have undeniably been cruelties to animals in menageries in times past. Those familiar with our leading gardens nowadays know how much expert care is given the animals, how contented and happy most of them are, and how much longer many species live in captivity than in a wild state. Most wild animals resist capture, it is true, but so does a colt or a domestic pig. Once safely in the modern zoological garden almost any wild creature rapidly becomes a contented pet. Kindness and consideration for his charges is one of the first essential qualifications required of the keeper, and no brutal or inhuman act is tolerated. In the first place, it does not pay; animals are expensive, and every care must be taken to insure that contentment necessary to good health and a long survival. The management now is most certain to be made up of animal lovers and protectionists, men who are naturally kind to animals, and constantly working for their preservation and good. Improved buildings, cages, and paddocks are all the time being devised; improved methods of care are constantly being studied; any plan, in short, that tends to better conditions for the comfort and health of the animals is eagerly adopted as soon as its merits are proved.

The writer does not particularly care for trained animal shows, and does not know a great deal about methods used in teaching wild animals to perform, but he has had some acquaintance with trainers, and in so far as his experience goes has never seen or heard of, first hand, the "diabolical cruelty" so often credited to the profession. There may be a difference of opinion, of course, as to just what constitutes "diabolical cruelty," but the few professional animal trainers personally known to him have been kindly, big hearted men, with an intense love for animals; men who would be decidedly and vigorously quick to resent any act of cruelty, torture, or even annoyance to their pets. Isolated cases of cruelty to animals in zoos and menageries today are not representative of conditions in general. The zoo as a public institution should not be condemned because of such cases. The *National Humane Review* records many cases of extreme brutality and crime to children by acts of human monsters, but no one advocates the abolishment of the privilege of rearing children because of these unnatural, isolated cases.

Zoological parks and exhibitions of living animals will probably always be with us; the idea is growing in popularity all the time, and becomes more important as the natural ranges of wild creatures become restricted. Conspicuous species and groups of animals are being hunted and trapped from the face of the earth, or crowded out of existence by man's use of the land, and many forms will soon survive only in park-reared examples. Fortunate indeed may be the fare of the family of animals that is safely settled in a comfortable park paddock, while their kind in a wild state are being hunted to actual extermination.

Any cruelty or acts of negligence in the care of animals should be condemned. But it is folly, because of isolated cases in ill-managed menageries, to condemn all zoological collections; to advocate depriving the children of their joy, adults of their recreation and pleasure, and the scientists and artists of the opportunity for study. If the writers in the *Humane Review* were more familiar with actual conditions in our best up-to-date zoological gardens, they probably would not make such sweeping statements.

An official from the local Humane Society once visited the zoological park in Washington to investigate an alleged case of cruelty to a bear. After examining into the case he admitted that the charges were wholly false. When he returned to his carriage, however, an animal-loving park employee directed his attention to the extreme type of overcheck he was using. On his next visit to the park, this agent sheepishly admitted on inquiry that he had removed this check just before entering the grounds. He knew it was wrong, was ashamed again to be seen with it in the park, yet persisted in its use. But we do not sweepingly condemn all humane societies because of this isolated case of cruelty to his horse by one of their officials. In the main, they have our genuine sympathy and hearty support.

—N. H.

INDEX TO VOLUME I

[New names in **bold-face type**]

A

Alces shirasi, 20.
Allen, G. M., A bat new to the Japanese fauna, 139; An insular race of cotton rat from the Florida Keys, 235; Bats from Mount Whitney, California, 1; Bison remains from New England, 161; Hoy's shrew in Labrador, 139.
Allen, J. A., Note on Gueldenstaedt's names of certain species of Felidæ, 90; Preliminary notes on African carnivora, 23; review of Goldman's Mammals of Panama, 188; The technical names of two Colobus monkeys, 96.
Alopex hallensis, 121.
American Society of Mammalogists, organization meeting, 47; by-laws and rules, 49; second annual meeting, 199.
Anahyster, 23.
Anderson, R. M., review of Dall's Report on mollusks of Canadian Arctic expedition, 246; review of Rathbun's Report on decapod crustaceans of Canadian Arctic expedition, 246.
antelope, prong-horned, 128, 244.
Anthony, A. W., The wood rat as a harvester, 140.
Anthony, H. E., New rodents and new bats from Neotropical regions, 81.
Antrozous pacificus, 174.
Aonyx, 23, 24.
Arborimus, 243.
Ariela, 31.
Atilax, 26.

B

badger, California, 12.
Bailey, V., A new subspecies of beaver from North Dakota, 31; Identity of the bean mouse of Lewis and Clark, 70; Old and new horns of the prong-horned antelope, 128.
Baker, A. B., Breeding of the Brazilian tapir, 143.
Balæna mysticetus, 120.
Balænoptera velifera, 120.
Ballou, H. A., notice of his "Rats in the West Indies," 192.
bat, brown, 173.
  California leaf-nose, 172.
  California mastiff, 111.
  Georgian, 38.
  hoary, 11.
  interior long-legged, 4.
  large brown, 5.
  little California, 11.
  long-legged, 11.
  mastiff, 182.
  Mexican free-tail, 175.
  pale lump-nose, 174.
  pallid, 174.
  red, 87.
  silver-haired, 11.
  Tejon, 1, 173.
  white-edged, 2.
  Yuma, 173.
bear, black, 11.
  cinnamon, 11.
  polar, 121.
bears of Asia, 213.
beaver, 19, 31.
Berardius bairdii, 120.

bighorn, 20.
bison, 161.
Bison bison, 162.
Bos taurus, 163.
Bryant, H. C., The coyote not afraid of water, 87.
By-laws and rules, 49.

C

Cabrera, A., notice of his "Genera mammalium," 148.
Callorhinus alascanus, 121.
Callospermophilus chrysodeirus, 18.
Canis antarcticus, 34.
australis, 34.
estor, 87.
isodactylus, 35.
jubatus, 35.
lestes, 11.
Castor canadensis, 19.
missouriensis, **32.**
Cavia arequipæ, **34.**
pallidior, 34.
Cebus xanthosternos, 35.
Cervus canadensis, 20, 186.
mexicanus, 75
chipmunk, 94.
Klamath, 18.
Chrotopterus colombianus, **84.**
Chrysocyon brachyurus, 35.
Citellus columbianus, 17.
townsendii, 18.
Civettictis, 26.
Colobus ferruginosus, 97.
polycomus, 96.
Corynorhinus pallescens, 174.
cottontail, Washington, 20.
cougar, 240.
coyote, 87.
mountain, 11.
Crossarchus fasciatus, 28, 29.
obscurus, 30.

D

Dactylomys boliviensis, **82.**
dactylinus, 82, 84.
typus, 84.
Dall, W. H., notice of his "Report of the Canadian Arctic expedition—mollusks," 246.
Davis, J. J., notice of his "Contributions to a knowledge of the natural enemies of Phyllophaga," 44.
Dearborn, N., The fur situation, 144.
deer, northern Virginia, 130.
Pennant's Mexican, 75.
Rocky Mountain mule, 20.
deermouse, 134.
Delphinus occiduus, 100.
Dice, L. R., The mammals of southeastern Washington, 10.
Dipodomys brevinasus, **179.**
exilis, 178.
merriami, 178.
nitratoides, 178.
Dusicyon antarcticus, 34.

E

editorial comment, 47, 108, 159, 197, 250.
elk, American, 186.
Eptesicus fuscus, 5, 173.
Erethizon epixanthum, 17.
Eumops californicus, 111, 182.
Euphractus flavimanus, 33.
gilvipes, 33.
Eutamias amœnus, 18.
Evotomys saturatus, 14, 92.

F

Felis brasiliensis, 89.
caracal, 90.
griffithii, 89.
hippolestes, 13.
maraqua, 89.
ocelot, 88.
onca, 38.
pardalis, 88.
rufa, 91.
Fitzsimons, F. W., notice of his "Natural history of South Africa. Mammals," 246.
fox, red, 12.
white, 121.

G

Genetta victoriæ, 25.
Gidley, J. W., see Miller, G. S., and J. W. Gidley.
Gilmore, M. R., Food stored by the bean mouse, 157.
Glaucomys volans, 95.
goat, Missoula, 21.
Goldman, E. A., notice of his "Mammals of Panama," 188.
gopher, brown pocket, 16.
Columbian pocket, 16.
Grinnell, G. B., As to the wolverine, 182.
Grinnell, J., A new kangaroo rat from the San Joaquin Valley, California, 178; notice of his "California ground squirrels," 97.

H

Hall, H. M., and Joseph Grinnell, notice of their "Life-zone indicators in California," 245.
Hall, M. C., notice of his "The adult taenioid cestodes of dogs and cats, and related carnivores in North America," 44.
Hanna, G. D., Mammals of the St. Matthew Islands, Bering Sea, 118.
Harper, F., The Florida water-rat in Okefinokee Swamp, Georgia, 65.
Herpestes, 26, 27.
griseus, 29.
Hinton, M. A. C., notice of his "Report on the house rats of India, Burma, and Ceylon," 146.
Histiotus inambarus, 85.
Hollister, N., Dates of shedding of horns, 244; editorial comment, 47, 108, 159, 197, 250; notice of his "East African mammals in the U. S. National Museum," 43; review of Fitzsimon's Natural history of South Africa, 246.
Howell, A. B., A plea for more concise technical papers, 158; A second record of *Phenacomys albipes* in California, with a discussion of the species, 242; A supplementary note on cleaning skulls, 145; An easy method of cleaning skulls, 40; Contribution to the life-history of the California mastiff bat, 111; Microtus townsendi in the Cascade Mountains of Oregon, 141; Some Californian experiences with bat roosts, 169.
Howell, A. H., Death of Thomas M. Owen, 187; Description of a new race of the Florida water-rat, 79; Description of a new species of beach mouse from Florida, 237; Notes on the fox squirrels of southeastern United States, with description of a new form from Florida, 36; The Florida spotted skunk as an acrobat, 88.

I

Ichneumia, 26.
Ischyromys parvidens, 73.

J

Jackson, H. H., T., An apparent effect of winter inactivity upon distribution of mammals, 58; Diurnal nest-building by a wood rat, 241; review of Hall's Adult taenioid cestodes of carnivores in North America, 44; review of Davis's Contributions to a knowledge of the natural enemies of Phyllophaga, 44; The Georgian bat, *Pipistrellus subflavus*, in Wisconsin, 38; The second annual meeting of the American Society of Mammalogists, 199; The white-tailed jack rabbit, Lepus townsendii campanius, introduced into Wisconsin, 186.
jaguar, 38, 241.
Jewett, S. G., Notes on two species of Phenacomys in Oregon, 165.
Joleaud, L., notice of his "Les migrations des mammifères," etc., 190.

K

Kerodon, 34.

L

Lange, D., Notes on flying squirrels and gray squirrels, 243.
Lasionycetris noctivagans, 11.
Lasiurus borealis, 87.
Leptonyx, 24.
Lepus bairdii, 19.
campanius, 186.
townsendii, 19.
wallawalla, 19.
List of members, 201.
Little, L., Some notes concerning the mastiff bat, 182.
Lönnberg, E., notice of his "Remarks on some South American Canidæ," 149.
Lutra, 23.
lynx, 13.
Lynx rufa, 91.
ruffus, 13, 91.
rufus, 140.

M

Macrotus californicus, 172.
marmot, Montana hoary, 92.
pallid yellow-bellied, 17.
Marmota avara, 17.
nivaria, 92.
marten, 12.
Martes, 12.
Matthew, W. D., A new genus of rodents from the Middle Eocene, 168.
Mephitis major, 12.
putida, 140.
Melanarctos cavifrons, 230.
Merriam, C. H., Criteria for the recognition of species and genera, 6; Death of James M. Macoun, 187; Is the jaguar entitled to a place in the California fauna? 38; Why should every specimen be named? 41.
Micraonyx, 24, 25.
Microsciurus **septentrionalis, 81.**
Microsorex hoyi, 139.
Microtus, 11.
abbreviatus, 122.
arvicoloides, 94.
bairdi, 184.
Microtus canescens, 14.
cantwelli, 180.
mordax, 15.
oregoni, 180, 184.
pennsylvanicus, 185.
scalopsoides, 185.
townsendi, 141.
wahema, 72.
Miller, G. S., review of Ballou's Rats in the West Indies, 192; review of Cabrera's Genera mammalium, 148; review of Hinton's Report on the house rats of India, Burma, and Ceylon, 146; review of Joleaud's Les migrations des mammifères Américains et Africains, etc., 190; review of Lönnberg's Remarks on some South American Canidæ, 149; review of Neuville's De l'Extinction du Mammouth, 150.
Miller, G. S., and J. W. Gidley, A new fossil rodent from the Oligocene of South Dakota, 73.
mink, Pacific, 12.
mole, Scheffer, 11.
monkey, colobus, 96.
Monticavia, 34.
moose, 142.
Shiras, 20.
mouse, beach, 237.
bean, 70, 72, 157.
biting meadow, 15.
Blue Mountain jumping, 17.
Columbian pocket, 17.
dusky harvest, 13.
dusky red-backed, 14.
Gambel white-footed, 13.
gray grasshopper, 13.
gray meadow, 14.
Hall Island meadow, 122.
house, 15.
Northwest pocket, 16.
Oregon pocket, 16.
Rainier meadow, 180.
red-backed, 92.
sagebrush white-footed, 14.
white-headed beach, 239.

Mungos, 27.
Mus musculus, 15.
muskrat, Rocky Mountain, 15.
Mustela arizonensis, 12.
energumenos, 12.
lepta, 12.
Myotis **albicinctus, 2, 3, 4.**
altipetens, 3, 4, 5.
californicus, 11.
interior, 4, 5.
longicrus, 4, 11.
lucifugus, 1, 2, 3, 4, 5.
saturatus, 1, 2.
sociabilis, 1, 2, 5, 173.
subulatus, 3.
ussuriensis, 139.
yumanensis, 1, 2, 11, 173.

N

Neofiber alleni, 65, 79.
nigrescens, 79.
Neosorex navigator, 11.
Neotoma albigula, 91, 242.
occidentalis, 14, 91, 94.
orolestes, 233.
Neuville, H., notice of his "De l'Extinction du Mammouth," 150.
Nichols, J. T., Red bat and spotted porpoise off the Carolinas, 87.
Nycetris cinerea, 11.
Nyctinomus mexicanus, 175.

O

Odobenus divergens, 120.
Odocoileus borealis, 130.
hemionus, 20.
mexicanus, 77.
Ondatra osoyoosensis, 15.
Onychomys fuscogriseus, 13.
Orcinus orca, 120.
Oreamnos missoulæ, 21.
Osbornictis, 25.
piscivora, 25.
Osgood, W. H., Attacked by a cougar? 240; Names of some South American mammals, 43; review of Hollister's East African mammals in the U. S. National Museum, 43; The *Felis ocelot* of Hamilton Smith, 88; The status of Pennant's "Mexican deer," 75.
otter, clawless, 23.
Ovis canadensis, 20.

P

Palmer, W., review of Jordan and Gilbert's Fossil fishes of southern California. II, 100.
Paramys copei, 169.
delicatissimus, 168.
delicatus, 168.
Perodipus columbianus, 17.
Perognathus columbianus, 16, 17.
lordi, 16.
parvus, 16.
Peromyscus, 8.
albifrons, 238.
artemisiæ, 14.
gambelii, 13.
leucocephalus, 239.
leucopis, 185.
niveiventris, 238.
noveboracensis, 134.
oreas, 93.
phasma, 238.
polionotus, 237, 238.
rhoadsi, 238.
Phenacomys albipes, 165, 167, 242.
longicaudus, 165.
Phillips, J. C., Skull measurements in the northern Virginia deer, 130.
Phoca, 120.
Phocaena occiduus, 100.
Piliocolobus, 97.
Pipistrellus subflavus, 38.
porcupine, yellow-haired, 17.
porpoise, spotted, 87.
Procyon pacifica, 12.
Prodelphinus plagiodon, 87.
puma, Rocky Mountain, 13.

R

rabbit, Rocky Mountain snowshoe, 19.
Washington jack, 19.
western white-tailed jack, 19.
white-tailed jack, 186.

raccoon, Pacific, 12.
rat, bushy-tailed wood, 233.
Columbian kangaroo, 17.
cotton, 235.
Norway, 15.
western bushy-tailed wood, 14.
wood, 241.
Rathbun, M. J., notice of her "Report of the Canadian Arctic expedition—decapod crustaceans," 246.
Rattus norvegicus, 15.
recent literature, 43, 97, 146, 188, 245.
Reithrodontomys nigrescens, 13.
Reithroparamys, 168.

S

Saunders, A. A., The range of the hoary marmot in Montana, 92.
Scapanus schefferi, 11.
Sciurus avicennia, **37.**
carolinensis, 53.
douglasii, 93.
niger, 36.
richardsonii, 19.
rufiventer, 122.
seal, fur, 121.
hair, 120.
Selenarctos, 216.
formosanus, 223.
japonicus, 222.
leuconyx, 226.
macneilli, 220.
mupinensis, 219.
thibetanus, 218.
ussuricus, 220.
Seton, E. T., Acrobatic skunks, 140; Bobcats and wild turkeys, 140; Does the cuterebra ever emasculate its host? 94; English names of mammals, 104; Food of the red fox, 140; For a methodic study of life-histories of mammals, 67; Locality, date, and name with observations, 107; Migrations of the gr.ysquirrel, 53; Notes on the breeding habits of captive deermice, 134; The jaguar in Colorado, 241; The mole-mouse, potato-mouse, or pine-mouse, 185.
Shaw, W. T., notice of his "Cost of a squirrel and squirrel control," 192.
shrew, Dobson, 11.
Hoy's, 139.
navigator, 11.
Shufeldt, R. W., A work on the comparative osteology of the Procyonidæ, 196.
Sibbaldus sulfureus, 120.
Sigmodon **exsputus, 236.**
Skinner, M. P., Measurements of an unusual elk head, 186.
skunk, Great Basin, 12.
Sorex dobsoni, 11.
Sowerby, A. de C., Notes on Heude's bears in the Sikawei Museum, and on the bears of Palæarctic eastern Asia, 213.
Spelæus, 216, 228.
cavifrons, 230.
leuconyx, 232.
melanarctos, 230.
piscator, 231.
Spilogale ambarvalis, 88.
squirrel, Columbian ground, 17.
flying, 95, 243.
fox, 36.
golden-mantled ground, 18.
gray, 53, 243.
mangrove fox, 37.
Richardson, 19.
Townsend ground, 18.
Stoddard, H. L., Nests of the western fox squirrel, 122; The flying squirrel as a bird killer, 95.
Sylvilagus nuttallii, 20.

T

Tanton, T. L., Depressions found on moose trails and their significance, 142.
tapir, Brazilian, 143.
Tapirus terristris, 143.
Taverner, P. A., The test of the subspecies, 124.
Taxidea neglecta, 12.

Taylor, W. P., A California record of Microtus oregoni bairdi, 184; A new meadow mouse from the Cascade Mountains of Washington, 180; A novel nesting place of the red-backed mouse, 92; review of Grinnell's California ground squirrels, 97; review of Hall and Grinnell's Life-zone indicators in California, 245; review of Shaw's The cost of a squirrel and squirrel control, 192; Rodent mountaineers, 93; The "general notes" column, 106; The wood rat as a collector, 91.
Tayra sinuensis, 35.
Thalarctos maritimus, 121.
Thomomys columbianus, 16.
fuscus, 16.
Tolypeutes matacus, 33.

U

Ursarctos mandchuricus, 226.
Ursus, 216, 223.
altifrontalis, 11.
arctos, 223.
beringianus, 227.
clarki, 226.
collaris, 224.
formosanus, 223.
isabellinus, 225.
japonicus, 222.
lagomyiarius, 225.
leuconyx, 232.
macneilli, 220.
mandchuricus, 226.
melanarctos, 230.
Ursus piscator, 231.
pruinosus, 225.
spelæus, 228.
thibetanus, 216.
torquatus, 218.
yesoensis, 227.

V

Viverra mungo, 27.
Viverricula, 26.
vole, Townsend, 141.
Vulpes, 12.

W

walrus, 120.
wapiti, 20.
Warren, E. R., Notes on wood rat work, 233.
water-rat, Florida, 65, 79.
weasel, 12
mountain, 12.
whale, Baird's, 120.
bowhead, 120.
humpback, 120.
killer, 120.
sulphur-bottom, 120.
wolverine, 182.

X

Xenogale, 26.
microdon, 26, 27.

Z

Zaëdyus pichiy, 33.
Zapus oregonus, 17.